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DOCUMENT # DOE/RL 92-05 Draft A

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SECTION 1 OF 2

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DOE/RL-92-05
Draft A

B Plant Source Aggregate Area Management Study Report

United States
Department of Energy
Richland, Washington

Approved for Public Release

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Draft A

B Plant Source Aggregate Area Management Study Report

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B PLANT SOURCE AAMS EXECUTIVE SUMMARY

This report presents the results of an aggregate area management study (AAMS) for the B Plant Aggregate Area in the 200 Areas of the U.S. Department of Energy (DOE) Hanford Site in Washington State. This scoping level study provides the basis for initiating Remedial Investigation/Feasibility Study (RI/FS) activities under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) or Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFI) and Corrective Measures Studies (CMS) under RCRA. This report also integrates select RCRA treatment, storage or disposal (TSD) closure activities with CERCLA and RCRA past practice investigations.

Through the experience gained to date on developing work plans, closure plans, and permit applications at the Hanford Site, the parties to the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) have recognized that all past practice investigations must be managed and implemented under one characterization and remediation strategy, regardless of the regulatory agency lead (as defined in the Tri-Party Agreement). In particular, the parties have identified a need for greater efficiency over the existing RI/FS and RFI/CMS investigative approaches, and have determined that, to expedite the ultimate goal of cleanup, much more emphasis needs to be placed on initiating and completing waste site cleanup through interim measures.

This streamlined approach is described and justified in The *Hanford Federal Facility Agreement and Consent Order Change Package*, dated May 16, 1991 (Ecology et al. 1991). To implement this approach, the three parties have developed the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) for streamlining the past practice remedial action process. This strategy provides new concepts for:

- Accelerating decision-making by maximizing the use of existing data consistent with data quality objectives (DQOs)
- Undertaking expedited response actions (ERAs) and/or interim remedial measures (IRMs), as appropriate, to either remove threats to human health and welfare and the environment, or to reduce risk by reducing toxicity, mobility, or volume of contaminants.

The *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) describes the concepts and framework for the RI/FS (or RFI/CMS) process in a manner that has a bias-for-action through optimizing the use of interim remedial actions, culminating with decisions on final remedies on both an operable-unit and aggregate-area scale. The strategy focuses on reaching early decisions to initiate and complete cleanup projects, maximizing the use of existing data, coupled with focused short time-frame investigations, where necessary. As more data become available on contamination problems and associated risks, the details of the longer term investigations and studies will be better defined.

The strategy includes three paths for interim decision-making and a final remedy-selection process for the operable unit that incorporates the three paths and integrates sites not addressed in those paths. The three paths for interim decision-making include the ERA, IRM, and limited field investigation (LFI) paths. The strategy requires that aggregate area management study reports (AAMSRs) be prepared to provide an evaluation of existing site data to support initial path decisions. This AAMSR is one of ten reports that will be prepared for each of the ten aggregate areas defined in the 200 Areas.

The near-term past practice strategy for the 200 Areas provides for ERAs, IRMs, and LFIs for individual waste management units, waste management unit groups and groundwater plumes, and recommends separate source and groundwater operable units. Initial site-specific recommendations for each of the waste management units within the B Plant Aggregate Area are provided in the report. Work plans starting with the 200-BP-1 Operable Unit Work Plan will initially focus on limited intrusive investigations at the highest priority waste management units or waste management unit groups as established in the AAMSR. The goal of this initial focus is to establish whether IRMs are justified. Waste management units identified as candidate ERAs in Section 9.0 of the AAMS will be further evaluated following the *Site Selection Process for Expedited Response Actions at the Hanford Site* (Gustafson 1991).

While these elements may mitigate specific contamination problems through interim actions, the process of final remedy selection must be completed for the operable unit or aggregate area to reach closure. The aggregation of information obtained from the LFIs and interim actions may be sufficient to perform the cumulative risk assessment and to define the final remedy for the operable unit or aggregate area. If the data are not sufficient, additional investigations and studies will be performed to the extent necessary to support final remedy selection. These investigations would be performed within the framework and process defined for RI/FS programs.

Several integration issues exist that are generic to the overall past practice process for the 200 Areas and include the following:

Future Work Plan Scope. Although the current practice for implementing RI/FS (RFI/CMS) activities is through operable unit based work plans, individual LFI/IRMs may be more efficiently implemented using LFI/IRM-specific work plans.

Groundwater Operable Units. A general strategy recommended for the 200 Areas is to define separate operable units for groundwater affected by 200 Areas source terms. This requires that groundwater be removed from the scope of existing source operable units and new groundwater-specific operable units be established. Recommendations for groundwater operable units will be developed in the groundwater AAMSRs.

Work Plan Prioritization. Although priorities are established in the AAMSR for operable units within the aggregate area, priorities between aggregate areas have yet to be established. The integration of priorities at the 200 Areas level is considered a prerequisite for establishing a schedule for past practice activities in the 200 Areas.

It is intended that these integration issues be resolved following the completion of all ten AAMSRs (Draft A) scheduled for September 1992. Resolution of these issues will be based on a decisions/consensus process among the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and DOE. Following resolution of these issues a schedule for past practice activities in the 200 Areas will be prepared.

Background, environmental setting, and known contamination data are provided in Sections 2.0, 3.0, and 4.1. This information provides the basis for development of the preliminary conceptual model in Section 4.2 and for assessing health and environmental concerns in Section 5.0. Preliminary applicable or relevant and appropriate requirements (ARARs) (Section 6.0) and preliminary remedial action technologies (Section 7.0) are also developed based on this data. Section 8.0 provides a discussion of the data quality objectives. Data needs identified in Section 8.0 are based on data gaps determined during the development of the conceptual model, human health and environmental concerns, ARARs, and remedial action technologies. Recommendations in Section 9.0 are developed using all the information provided in the sections which precede it.

The Hanford Site, operated by the DOE, occupies about 1,450 km^2 (560 mi^2) of the southeastern part of Washington north of the confluence of the Yakima and Columbia Rivers. The Hanford Site was established in 1943 to produce plutonium for nuclear weapons using production reactors and chemical processing plants. The B Plant Aggregate Area is located within the 200 East Area, near the middle of the Hanford Site. There are thirteen operable units within the B Plant Aggregate Area.

Between 1945 and 1952, plutonium was recovered from irradiated fuel elements using the bismuth phosphate process. The use of this process was discontinued in 1952. In 1952, processing began at U Plant to recover uranium from the wastes produced during processing at B Plant prior to its shutdown. The uranium recovery processing generated additional waste which was disposed of in the B Plant Aggregate Area. The uranium recovery processing continued until 1957. In 1968, processing began to recover cesium and strontium fission products from wastes stored at B Plant and from wastes produced by PUREX processing. The cesium and strontium were initially stored as liquids. In 1974, processing began in the new Waste Encapsulation and Storage Facility (WESF) to precipitate and encapsulate the recovered cesium and strontium. This processing ended in 1984, but storage of the encapsulated cesium and strontium continues to the present.

The B Plant Aggregate Area contains a large variety of waste disposal and storage facilities. High-level wastes were stored in underground single-shell tanks. Low-level wastes such as cooling and condensate water were allowed to infiltrate into the ground through cribs, ditches, trenches, reverse wells, and open ponds. Based on construction, purpose, or origin, the B Plant Aggregate Area waste management units fall into one of ten subgroups as follows:

- 4 (No. of waste management units) Plants, Buildings, and Storage Areas
- 49 Tanks and Vaults
- 30 Cribs and Drains
- 5 Reverse Wells
- 43 Ponds, Ditches, and Trenches
- 18 Septic Tanks and Associated Drain Fields
- 18 Transfer Facilities, Diversion Boxes, and Pipelines
- 3 Basins
- 13 Burial Sites
- 59 Unplanned Releases.

Detailed descriptions of these waste management units are provided in Section 2.3.

There are several ongoing programs that affect buildings and waste management units in the B Plant Aggregate Area (Section 2.7). These programs include RCRA, the Hanford Surplus Facilities Program, the Radiation Area Remedial Action (RARA) Program, the Hanford Site Single-Shell Tank Program, and the Defense Waste Management Program. One hundred four units (primarily single-shell tanks and associated transfer facilities) fall completely within the scope of one of these programs and, therefore, recommendations on these units will be made by the respective programs rather than in this AAMS. An additional forty-nine waste management units will be partially addressed by an ongoing program in addition to the actions recommended in the B Plant AAMS. Ten waste management units are within the 200-BP-1 Operable Unit and are not evaluated because a remedial investigation is already underway.

Discussions of surface hydrology and geology are provided on a regional, Hanford Site, and aggregate area basis in Section 3.0. The interpretation is based on a limited number of wells, and this limitation does not support a detailed delineation of waste management unit-specific features. The section also describes the flora and fauna, land use, water use, and human resources of the 200 East Area and vicinity. Groundwater of the 200 East Area is described in detail in a separate Groundwater AAMSR.

A preliminary site conceptual model is presented in Section 4.0. Section 4.1 presents the chemical and radiological data that are available for the different media types (including surface soil, vadose zone soil, air, surface water, and biota) and site-specific data for each waste management unit and unplanned release.

A preliminary assessment of potential impacts to human health and the environment is presented in Section 4.2. This assessment includes a discussion of release mechanisms, potential transport pathways, and a preliminary conceptual model of human exposure based on these pathways. Physical, radiological, and toxicological characteristics of the known and suspected contaminants at the aggregate area are also discussed.

Health and environmental concerns are presented in Section 5.0. The preliminary qualitative evaluation of potential human health concerns is intended to provide input to the waste management unit recommendation process. The evaluation includes (1) an identification of contaminants of potential concern for each exposure pathway that is likely to occur within the B Plant Aggregate Area, (2) identification of exposure pathways applicable to individual waste management units, and (3) estimates of relative hazard based on four available indicators of risk; the CERCLA Hazard Ranking System (HRS) and modified HRS (mHRS), surface radiation survey data, and Westinghouse Environmental Protection Group site scoring.

Potential ARARs to be used in developing and assessing various remedial action alternatives at the B Plant Aggregate Area are discussed in Section 6.0. Specific potential requirements pertaining to hazardous and radiological waste management, remediation of contaminated soils, surface water protection, and air quality are discussed.

Preliminary remedial action technologies are presented in Section 7.0. The process includes identification of remedial action objectives (RAOs), determination of general response actions, and identification of specific process options associated with each option type. The process options are screened based on their effectiveness, implementability and cost. The screened process options are combined into alternatives and the alternatives are described.

Data quality is addressed in Section 8.0. Identification of chemical and radiological constituents associated with the units and their concentrations, with a view to determine the contaminants of concern and their action levels, is a major requirement to execute the *Hanford Site Past-Practice Strategy*. There was found to be a limited amount of data in this regard. The section provides a summary of data needs identified for each of the waste management units in the B Plant Aggregate Area. The data needs provide the basis for development of detailed DQOs in subsequent work plans.

Section 9.0 provides management recommendations for the B Plant Aggregate Area based on the *Hanford Site Past-Practice Strategy*. Criteria for selecting appropriate *Hanford Site Past-Practice Strategy* paths (ERA, IRM, and final remedy selection) for individual waste management units and unplanned releases in the B Plant Aggregate Area are developed in Section 9.1. As a result of the data evaluation process, one waste management unit was recommended for an ERA, 58 units were recommended for LFIs which could lead to IRMs and 79 units were recommended for final remedy selection. A discussion of the data evaluation process is provided in Section 9.2. Table ES-1 provides a summary of the results of the data evaluation assessment of each unit. Table ES-2 provides the decision matrix patterns each unit followed in reaching the recommendation. Recommendations for redefining operable unit boundaries and prioritizing operable units for work plan development are provided in Section 9.3. Included in Section 9.3.4 are the interactions with RCRA required to disposition the waste management units which are operating under RCRA permits. All recommendations for future characterization needs will be more fully developed and implemented through work plans. Sections 9.4 and 9.5 provide recommendations for focused feasibility and treatability studies, respectively.

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
Tanks and Vaults							
241-B-361 Settling Tank	--	--	--	--	X	--	HSFP
Cribs and Drains							
216-B-7A Crib	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-7B Crib	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-8TF Crib/Tile Field	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-9TF Crib/Tile Field	--	X	X	--	--	X	RARA-Collapse Potential
216-B-10A Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-10B Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-12 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-14 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-15 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-16 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-17 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-18 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-19 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-43 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-44 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-45 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-46 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-47 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-48 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-49 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-50 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-55 Crib	--	X	X	--	--	--	Active-DWMP/Surface Contamination
216-B-56 Crib	--	--	--	--	--	--	--
216-B-57 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-60 Crib	--	--	--	--	X	--	--
216-B-61 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-62 Crib	--	--	--	--	X	--	Active-DWMP
CTF North of 2703-E	--	--	--	--	X	--	--
216-B-13 French Drain	--	--	--	--	X	--	--
216-B-51 French Drain	--	X	X	--	--	X	RARA-Surface Contamination
Reverse Wells							
216-B-4 Reverse Well	--	X	X	--	--	--	--
216-B-5 Reverse Well	X	--	--	--	--	--	Surface Contamination
216-B-6 Reverse Well	--	X	X	--	--	--	--
216-B-11A Reverse Well	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-11B Reverse Well	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
Ponds, Ditches, and Trenches							
216-B-3 Pond	--	X	X	--	--	X	Active-DWMP/RARA-Surface Contamination
216-B-3A Pond	--	X	X	--	--	--	Active-DWMP

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-3B Pond	--	X	X	--	--	--	Active-DWMP
216-B-3C Pond	--	X	X	--	--	--	Active-DWMP
216-A-25 Pond	--	--	--	--	X	--	--
216-E-28 Contingency Pond	--	--	--	--	X	--	--
216-N-8 Pond	--	--	--	--	X	--	--
216-B-2-1 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-2-2 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-2-3 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-3-1 Ditch	--	X	X	--	--	--	--
216-B-3-2 Ditch	--	X	X	--	--	--	--
216-B-3-3 Ditch	--	X	X	--	--	--	Active-DWMP
216-B-20 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-21 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-22 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-23 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-24 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-25 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-26 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-27 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-28 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-29 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-30 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-31 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-32 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-33 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-34 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-35 Trench	--	--	--	--	X	--	--
216-B-36 Trench	--	--	--	--	X	--	--
216-B-37 Trench	--	--	--	--	X	--	--
216-B-38 Trench	--	--	--	--	X	--	--
216-B-39 Trench	--	--	--	--	X	--	--
216-B-40 Trench	--	--	--	--	X	--	--
216-B-41 Trench	--	--	--	--	X	--	--
216-B-42 Trench	--	--	--	--	X	--	--
216-B-52 Trench	--	--	--	--	X	--	--
216-B-53A Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-53B Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-54 Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-58 Trench	--	--	--	--	X	X	RARA-Collapse Potential
216-B-63 Trench	--	X	X	--	--	--	Active-DWMP Grouped with 216-B-2-1 Ditch
Septic Tanks and Associated Drain Fields							
2607-E1 Septic Tank	--	--	--	--	X	--	Active

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
2607-E2 Septic Tank	--	--	--	--	X	--	Active
2607-E3 Septic Tank/Drain Field	--	--	--	--	X	--	Active
2607-E4 Septic Tank	--	--	--	--	X	--	Active
2607-E7B Septic Tank	--	--	--	--	X	--	Active
2607-E8 Septic Tank	--	--	--	--	X	--	Active
2607-E9 Septic Tank	--	--	--	--	X	--	Active
2607-E11 Septic Tank	--	--	--	--	X	--	Active
2607-EB Septic Tank	--	--	--	--	X	--	Active
2607-EH Septic Tank	--	--	--	--	X	--	Active
2607-EK Septic Tank	--	--	--	--	X	--	Active
2607-EM Septic Tank	--	--	--	--	X	--	Active
2607-EN Septic Tank	--	--	--	--	X	--	Active
2607-EO Septic Tank	--	--	--	--	X	--	Active
2607-EP Septic Tank	--	--	--	--	X	--	Active
2607-EQ Septic Tank	--	--	--	--	X	--	Active
2607-ER Septic Tank	--	--	--	--	X	--	Active
2607-GF Septic Tank	--	--	--	--	X	--	Active
Basins							
207-B Retention Basin	--	X	X	--	--	--	Active-DWMP
216-B-59B Retention Basin	--	--	--	--	X	--	Active-DWMP

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-64 Retention Basin	--	X	X	--	--	X	RARA-Surface Contamination
				Burial Sites			
218-E-2 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-2A Burial Ground	--	--	--	--	X	--	--
218-E-3 Burial Ground	--	--	--	--	X	--	Exhumed/Released
218-E-4 Burial Ground	--	X	X	--	--	--	--
218-E-5 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-5A Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-6 Burial Ground	--	--	--	--	X	--	Exhumed/Released
218-E-7 Burial Ground	--	--	--	--	X	X	RARA-Collapse Potential
218-E-9 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
200 Area Construction Pit	--	--	--	--	X	--	--
				Unplanned Releases			
UN-200-E-7	--	--	--	--	X	--	--
UN-200-E-9	--	--	--	--	X	--	--
UN-200-E-14	--	--	--	--	X	--	--
UN-200-E-41	--	X	X	--	--	--	Grouped with UN-200-E-69
UN-200-E-43	--	X	X	--	--	--	Grouped with 216-B-57
UN-200-E-44	--	X	X	--	--	--	--
UN-200-E-52	--	X	X	--	--	--	Grouped with UN-200-E-69
UN-200-E-54	--	--	--	--	X	--	--

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
UN-200-E-55	--	--	--	--	X	--	--
UN-200-E-61	--	--	--	--	X	--	--
UN-200-E-63	--	X	X	--	--	X	RARA-Surface Contamination
UN-200-E-64	--	X	X	--	--	--	RARA-Surface Contamination
UN-200-E-69	--	X	X	--	--	--	--
UN-200-E-79	--	--	--	--	X	--	--
UN-200-E-80	--	X	X	--	--	--	--
UN-200-E-83	--	X	X	--	--	X	RARA-Surface Contamination
UN-200-E-87	--	--	--	--	X	--	--
UN-200-E-90	--	X	X	--	--	--	--
UN-200-E-92	--	--	--	--	X	--	--
UN-200-E-95	--	X	X	--	--	--	Surface Contamination
UN-200-E-101	--	--	--	--	X	--	--
UN-200-E-103	--	X	X	--	--	--	Grouped with UN-200-E-44
UN-200-E-112	--	--	--	--	X	--	--
UN-200-E-140	--	--	--	--	X	--	--
UPR-200-E-4	--	--	--	--	X	--	--
UPR-200-E-32	--	X	X	--	--	X	RARA-Surface Contamination
UPR-200-E-34	--	--	--	--	X	--	--
UPR-200-E-51	--	--	--	--	X	--	--

Table ES-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
UPR-200-E-84	--	X	X	--	--	X	RARA-Surface Contamination
UPR-200-E-138	--	X	X	--	--	--	Grouped with 216-B-2-1 Ditch

ERA - Expedited Response Action
IRM - Interim Remedial Measure
LFI - Limited Field Investigation
RA - Risk Assessment
RI - Remedial Investigation
OPS - Operational Programs
DWMP - Defense Waste Management Program
RARA - Radiation Area Remedial Action Program
HSFP - Hanford Surplus Facilities Program

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
Tanks and Vaults													
241-B-361 Settling Tank	Y	N	–	–	–	–	–	–	N	–	–	–	N
Cribs and Drains													
216-B-7A Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-7B Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-8TF Crib/Tile Field	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-9TF Crib/Tile Field	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-10A Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-10B Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-12 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-14 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-15 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-16 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-17 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-18 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-19 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-43 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-44 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-45 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-46 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-47 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-48 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-49 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-50 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-55 Crib	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-56 Crib	N	–	–	–	–	–	–	–	N	–	–	–	N
216-B-57 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-60 Crib	N	–	–	–	–	–	–	–	N	–	–	–	N
216-B-61 Crib[a/]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-62 Crib	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
CTF North of 2703-E	Y	Y	N	–	–	–	–	–	N	–	–	–	N
216-B-13 French Drain	Y	Y	N	–	–	–	–	–	N	–	–	–	N
216-B-51 French Drain	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
Reverse Wells													
216-B-4 Reverse Well	Y	Y	Y	Y	N	–	–	–	Y	N	–	Y	–
216-B-5 Reverse Well	Y	Y	Y	Y	Y	Y	N	N	–	–	–	–	–
216-B-6 Reverse Well	Y	Y	Y	Y	N	–	–	–	Y	N	–	Y	–
216-B-11A Reverse Well	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-11B Reverse Well	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
Ponds, Ditches, and Trenches													
216-B-3 Pond	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-3A Pond	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3B Pond	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3C Pond	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-A-25 Pond	N	–	–	–	–	–	–	–	N	–	–	–	N
216-E-28 Contingency Pond	N	–	–	–	–	–	–	–	N	–	–	–	N
216-N-8 Pond	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N
216-B-2-1 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-2-2 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path							IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-2-3 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-3-1 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3-2 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3-3 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-20 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-21 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-22 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-23 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-24 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-25 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-26 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-27 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-28 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-29 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-30 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-31 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-32 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-33 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-34 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-35 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-36 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-37 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-38 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-39 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-40 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-41 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-42 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-52 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-53A Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-53B Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-54 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-58 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-63 Trench	Y	Y	Y	Y	N	--	--	--	N	--	--	--	N
Septic Tanks and Associated Drain Fields													
2607-E1 Septic Tank	N	--	--	--	--	--	--	--	N	--	--	--	N
2607-E2 Septic Tank	N	--	--	--	--	--	--	--	N	--	--	--	N

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
2607-E3 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E4 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E7B Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E8 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E9 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E11 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EB Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EH Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EK Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EM Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EN Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EO Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EP Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EQ Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-ER Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-GF Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
Basins													
207-B Retention Basin	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-59B Retention Basin	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
216-B-64 Retention Basin	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
Burial Sites													
218-E-2 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-2A Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-3 Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-4 Burial Ground	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
218-E-5 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-5A Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-6 Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-7 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
218-E-9 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
200-East Area Construction Pit	N	–	–	–	–	–	–	–	N	–	–	–	N
Unplanned Releases													
UN-200-E-7	Y	Y	N	–	–	–	–	–	N	–	–	–	N

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
UN-200-E-9	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-14	N	--	--	--	--	--	--	--	N	--	--	--	N
UN-200-E-41	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-43	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-44	Y	Y	Y	Y	N	--	--	--	Y	N	--	Y	--
UN-200-E-52	Y	Y	Y.	N	--	--	--	--	N	--	--	--	N
UN-200-E-54	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-55	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-61	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-63	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
UN-200-E-64	Y	Y	Y	Y	N	--	--	--	Y	N	--	Y	--
UN-200-E-69	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
UN-200-E-79	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-80	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
UN-200-E-83	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
UN-200-E-87	Y	Y	N	--	--	--	--	--	N	--	--	--	N
UN-200-E-90	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
UN-200-E-92	Y	Y	N	--	--	--	--	--	N	--	--	--	N

Table ES-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
UN-200-E-95	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
UN-200-E-101	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
UN-200-E-103	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-112	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-140	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UPR-200-E-4	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UPR-200-E-32	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UPR-200-E-34	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N
UPR-200-E-51	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N
UPR-200-E-84	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UPR-200-E-138	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N

[a/] Work is in progress under the 200-BP-1 RI/FS Work Plan
* DOE/RL 1991a
Other information from WIDS and HISS database

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ACRONYMS AND ABBREVIATIONS

AAMS	aggregate area management study
AAMSR	aggregate area management study report
AEA	Atomic Energy Act
AFAN	ammonium fluoride - ammonium nitrate
AKART	all known, available, and reasonable treatment technologies
ALARA	as low as reasonably achievable
AMU	aqueous makeup unit
ANSI	American National Standards Institute
ARARs	applicable or relevant and appropriate requirements
ARCL	allowable residual contamination level
ASD	ammonia scrubber distillate
ASIL	acceptable source impact level
ASME	American Society of Mechanical Engineers
BAT	best available technology
BDAT	best demonstrated available treatment technologies
BWIP	Basalt Waste Isolation Project
CCW	constituent concentrations in waste
CCWE	constituent concentrations in waste extract
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CMS	Corrective Measures Studies
CRP	Community Relations Plan
CSL	chemical sewer
CWA	Clean Water Act
CWL	cooling water
DCG	Derived Concentration Guide
DOE	U.S. Department of Energy
DOE/RL	U.S. Department of Energy, Richland Field Office
DWMP	Defense Waste Management Program
DQO	data quality objective
EC	evaporator - crystallizer
Ecology	Washington State Department of Ecology
EDMC	Environmental Data Management Center
EHPSS	Environmental Health and Pesticide Services Section
EII	Environmental Investigations Instructions
EIMP	Environmental Information Management Plan
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency

ACRONYMS AND ABBREVIATIONS (cont.)

ERA	expedited response actions
ERRA	Environmental Restoration Remedial Action
ES&H	Environment, Safety, and Health
FFS	focused feasibility study
FOMP	Field Office Management Plan
FRS	final remedy selection
FS	feasibility study
FWQC	Federal Water Quality Criteria
GTR	Grout Treatment Facility
HAPO	Hanford Atomic Products Operation
Health	Washington State Department of Health
HEDL	Hanford Engineering and Development Laboratory
HEHF	Hanford Environmental Health Foundation
HEIS	Hanford Environmental Information System
HEPA	high efficiency particulate air
HISS	Hanford Inactive Site Survey
HMS	Hanford Meteorological Station
HRS	Hazard Ranking System
HWOP	Hazardous Waste Operations Permit
HWSA	Hazardous Waste Staging Area
ICRP	International Commission on Radiological Protection
IRM	interim remedial measure
ITS	In-Tank Solidification
JSA	Job Safety Analysis
LDR	land disposal restriction
LFI	limited field investigation
LLRW	low-level radioactive waste
LSC	liquid scintillation counting
MCL	maximum contaminant levels
MCS	Management Control System
MEPAS	Multimedia Environmental Pollutant Assessment System
mHRS	modified Hazard Ranking System
MTCA	Model Toxics Control Act
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFA	no further action
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission

ACRONYMS AND ABBREVIATIONS (cont.)

NSPS	New Source Performance Standards
OSHA	Occupational Safety and Health Administration
OSM	Office of Sample Management
P&O	pipe and operating
PARCC	precision, accuracy, representativeness, completeness, comparability
PA	preliminary assessment
PDD	process condensate
PNL	Pacific Northwest Laboratory
PSPL	Puget Sound Power and Light Company
PUREX	plutonium uranium extraction
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	risk assessment
RAO	remedial action objective
RARA	Radiation Area Remedial Action
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
REDOX	reduction and oxidation
RI	remedial investigation
RFI	RCRA Facility Investigations
RLS	Radionuclide Logging System
ROD	record of decision
RTECS	Registry of Toxic Effects of Chemical Systems
RWP	Radiation Work Permit
SARA	Superfund Amendments and Reauthorization Act
SCIR	Surveillance and Compliance Inspection Report
SDWA	Safe Drinking Water Act
SI	site inspection
SWP	special work permit
TAP	Toxic Air Pollutant
T-BACT	toxic best available control technology
TBC	to-be-considered material
TCLP	toxicity characteristic leaching procedure
TLD	thermoluminescent dosimeter
TOC	total organic carbon
TRAC	Tracks Radioactive Components
Tri-Party Agreement	Hanford Federal Facility Agreement and Consent Order
TRU	transuranic
TSD	treatment, storage or disposal

ACRONYMS AND ABBREVIATIONS (cont.)

UO_3	uranium trioxide
USC	U.S. Code
USGS	U.S. Geological Survey
VOC	volatile organic compound
WAC	Washington Administrative Code
WIDS	Waste Information Data System
WIPP	Waste Isolation Pilot Plant
WISHA	Washington Industrial Safety and Health Act
WMP	Waste Management Plan
WPCA	Washington State Water Pollution Control Act

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Hanford Site in Washington State is organized into numerically designated operational areas including the 100, 200, 300, 400, 600, and 1100 Areas (Figure 1-1). The U.S. Environmental Protection Agency (EPA), in November 1989, included the 200 Areas of the Hanford Site on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. Inclusion on the NPL initiates the Remedial Investigation (RI) and Feasibility Study (FS) process for characterizing the nature and extent of contamination, assessing risks to human health and the environment, and selection of remedial actions.

This report presents the results of an aggregate area management study (AAMS) for the B Plant Aggregate Area located in the 200 Areas. The study provides the basis for initiating RI/FS under CERCLA or under the Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFI) and Corrective Measures Studies (CMS). This report also integrates RCRA treatment, storage or disposal (TSD) closure activities with CERCLA and RCRA past practice investigations.

This chapter describes the overall AAMS approach for the 200 Areas, defines the purpose, objectives and scope of the AAMS, and summarizes the quality assurance (QA) program and contents of the report.

1.1 OVERVIEW

The 200 Areas, located near the center of the Hanford Site, encompasses the 200 West, East, and North Areas which contain reactor fuel processing and waste management facilities.

Under the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), signed by the Washington State Department of Ecology (Ecology), DOE, and EPA (Ecology et al. 1990), the 200 NPL Site encompasses the 200 Areas and selected portions of the 600 Area. The 200 NPL Site is divided into 8 waste area groups largely corresponding to the major processing plants (e.g., B Plant and T Plant), and a number of isolated operable units located in the surrounding 600 Area. Each waste area group is further subdivided into one or more operable units based on waste disposal information, location, facility type, and other site characteristics. The 200 NPL site includes a total of 44 operable units including 20 in the 200 East Area, 17 in the 200 West Area, 1 in the 200 North Area, and 6 isolated operable units. The intent of defining operable units was to group associated waste management units together, such that they could be effectively characterized and remediated under one work plan.

The Tri-Party Agreement also defines approximately 25 RCRA TSD groups within the 200 Areas which will be closed or permitted (for operation or postclosure care) in accordance with the Washington State Dangerous Waste Regulations (WAC 173-303). The TSD facilities are often associated with an operable unit and are required to be addressed concurrently with past-practice activities under the Tri-Party Agreement.

This AAMS is one of ten studies that will provide the basis for past practice activities for operable units in the 200 Areas. In addition, the AAMS will be collectively used in the initial development of an area-wide groundwater model, and conduct of an initial site-wide risk assessment. Recent changes to the Tri-Party Agreement (Ecology et al. 1991), and the *Hanford Site Past-Practice Strategy* document (DOE/RL 1992a) establish the need and provide the framework for conducting AAMS in the 200 Areas.

1.1.1 Tri-Party Agreement

The Tri-Party Agreement was developed and signed by representatives from the EPA, Ecology, and DOE in May 1989, and revised in 1990 and 1991. The scope of the agreement covers all CERCLA past practice, RCRA past practice, and RCRA TSD activities on the Hanford Site. The purpose of the Tri-Party Agreement is to ensure that the environmental impacts of past and present activities are investigated and appropriately remediated to protect human health and the environment. To accomplish this, the Tri-Party Agreement provides a framework and schedule for developing, prioritizing, implementing, and monitoring appropriate response actions.

The 1991 revision to the Tri-Party Agreement requires that an aggregate area approach be implemented in the 200 Areas based on the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a). This strategy requires the conduct of AAMS which are similar in nature to an RI/FS scoping study. The Tri-Party Agreement change package (Ecology et al. 1991) specifies that 10 Aggregate Area Management Study Reports (AAMSR) (major milestone M-27-00) are to be prepared for the 200 Areas. Further definition of aggregate areas and the AAMS approach is provided in Sections 1.2 and 1.3.

1.1.2 Hanford Site Past Practice Strategy

The *Hanford Past-Practice Strategy* was developed between Ecology, EPA, and DOE to streamline the existing RI/FS and RFI/CMS processes. A primary objective of this strategy is to develop a process to meet the statutory requirements and integrate CERCLA RI/FS and RCRA Past Practice RFI/CMS guidance into a singular process for the Hanford Site that ensures protection of human health and welfare and the environment. The strategy refines the existing past practice decision-making process as defined in the Tri-Party Agreement. The fundamental principle of the strategy is a bias-for-action by optimizing the use of existing data, integrating past practice with RCRA TSD closure investigations, focusing the RI/FS process, conducting interim remedial actions, and reaching early decisions to initiate and complete cleanup projects on both operable-unit and aggregate-area scale. The ultimate goal is the comprehensive cleanup or closure of all contaminated areas at the Hanford Site at the earliest possible date in the most effective manner.

The process under this strategy is a continuum of activities whereby the effort is refined based upon knowledge gained as work progresses. Whereas the strategy is intended to streamline investigations and documentation to promote the use of interim actions to accelerate cleanup, it is consistent with RI/FS and RFI/CMS processes. An important element of this strategy is the application of the observational approach, in which characterization data are collected concurrently with cleanup.

For the 200 Areas the first step in the strategy is the evaluation of existing information presented in AAMSR. Based on this information, decisions are made regarding which strategy path(s) to pursue for further actions in the aggregate area. The strategy includes three paths for interim decision making and a final remedy-selection process that incorporates the three paths and integrates sites not addressed in those paths. As shown on Figure 1-2, the three paths for decision making are the following:

- Expedited response action (ERA) path, where an existing or near-term unacceptable health or environmental risk from a site is determined or suspected, and a rapid response is necessary to mitigate the problem

- Interim remedial measure (IRM) path, where existing data are sufficient to indicate that the site poses a risk through one or more pathways and additional investigations are not needed to screen the likely range of remedial alternatives for interim actions; if a determination is made that an IRM is justified, the process proceeds to select an IRM remedy and a focused FS, if needed, to select a remedy

- Limited field investigation (LFI) path, where minimum site data are needed to support IRM or other decisions, and is obtained in a less formal manner than that needed to support a final Record of Decision (ROD). Data generated from a LFI may be sufficient to directly support an interim ROD. Regardless of the scope of the LFI, it is a part of the RI process, and not a substitute for it.

The process of final remedy selection must be completed for the aggregate area to reach closure. The aggregation of information obtained from LFI and interim actions may be sufficient to perform the cumulative risk assessment and to define the final remedy for the aggregate area or associated operable units. If the data are not sufficient, additional investigations and studies will be performed to the extent necessary to support final remedy selection. These investigations would be performed within the framework and process defined for RI/FS or RFI/CMS programs.

1.2 200 NPL SITE AGGREGATE AREA MANAGEMENT STUDY PROGRAM

The overall approach and scope of the 200 Areas AAMS program is based on the Tri-Party Agreement and the *Hanford Site Past-Practice Strategy*.

1.2.1 Overall Approach

As defined in the 1991 revision to the Tri-Party Agreement, the AAMS program for the 200 Areas consists of conducting a series of ten AAMS for eight source (Figures 1-3 and 1-4) and two groundwater aggregate areas delineated in the 200 East, West, and North Areas. Table 1-1 lists the aggregate areas, the type of study and associated operable units. With the exception of 200-IU-6, isolated operable units associated with the 200 NPL site (Figure 1-5) are not included in the AAMS program. Generally, the quantity of existing information associated with isolated operable units is not considered sufficient to require study on an aggregate area basis prior to work plan development. Operable unit 200-IU-6 is addressed as part of the B Plant AAMS because of similarities in waste management units (i.e., ponds).

The eight source AAMS are designed to evaluate source terms on a plant-wide scale. Source AAMS are conducted for the following aggregate areas (waste area groups) which largely correspond to the major processing plants including the following:

- U Plant
- Z Plant
- S Plant
- T Plant
- PUREX

- B Plant

- Semi-Works

- 200 North.

The groundwater beneath the 200 Areas is investigated under two groundwater AAMS on an Area-wide scale (i.e., 200 West and 200 East Areas). Groundwater aggregate areas were delineated to encompass the geography necessary to define and understand the local hydrologic regime, and the distribution, migration and interaction of contaminants emanating from source terms. The groundwater aggregate areas are considered an appropriate scale for developing conceptual and numerical groundwater models.

The U.S. Department of Energy, Richland Field Office (DOE/RL) functions as the "lead agency" for the 200 AAMS program. Depending on the specific AAMS, EPA and/or Ecology function as the "Lead Regulatory Agency" (Table 1-1). Through periodic (monthly) meetings information is transferred and regulators are informed of the progress of the AAMS such that decisions established under the *Hanford Site Past-Practice Strategy* (e.g., is an ERA justified?) (Figure 1-2) can be quickly and collectively made between the three parties. These meetings will continually refine the scope of AAMS as new information is evaluated, decisions are made and actions taken. Completion milestones for AAMS are defined in Ecology et al. (1991) and duplicated in Table 1-1. All AAMSR are submitted as Secondary Documents which are defined in the Tri-Party Agreement as informational documents.

1.2.2 Process Overview

Each AAMS consists of three steps: (1) the analysis of existing data and formulation of a preliminary conceptual model, (2) identification of data needs and evaluation of remedial technologies, and (3) conduct of limited field characterization activities. Steps 1 and 2 are components of an AAMSR. Step 3 is a parallel effort for which separate reports will be produced.

The first and primary task of the AAMS investigation process involves the search, compilation and evaluation of existing data. Information collected for these purposes includes the following:

- Facility and process descriptions and operational histories for waste sources

- Waste disposal records defining dates of disposal, waste types, and waste quantities

- Sampling events of waste effluents and effected media

- Site conditions including the site physiography, geology, hydrology, meteorology, ecology, demography, and archaeology

- Environmental monitoring data for affected media including air, surface water, sediment, soil, groundwater and biota.

Collectively this information is used to identify contaminants of concern, determine the scope of future characterization efforts, and to develop a preliminary conceptual model of the aggregate area. Although data collection objectives are similar, the types of information collected depend on whether the study is a source or groundwater AAMS. The data collection step serves to avoid duplication of previous efforts and facilitates a more focused investigation by the identification of data gaps.

Topical reports referred to as Technical Baseline Reports are initially prepared to summarize facility information. These reports describe individual waste management units and unplanned releases contained in the aggregate area as identified in the Waste Information Data System (WIDS) (WHC 1991a). The reports are based on review of current and historical Hanford Site reports, engineering drawings and photographs and are supplemented with site inspections and employee interviews. Information contained in the reports is summarized in the AAMSR. Other topical reports are used as sources of information in the AAMSR. These reports are as follows:

- U Plant Geologic and Geophysics Data Package

- Z Plant Geologic and Geophysics Data Package

- S Plant Geologic and Geophysics Data Package

- T Plant Geologic and Geophysics Data Package

- PUREX Geologic and Geophysics Data Package

- B Plant Geologic and Geophysics Data Package

- 200 N Geologic and Geophysics Data Package

- Semiworks Geologic and Geophysics Data Package

- Hydrologic Model for the 200 West Groundwater Aggregate Area

- Hydrologic Model for the 200 East Groundwater Aggregate Area

- Unconfined Aquifer Hydrologic Test Data Package for the 200 West Groundwater Aggregate Area

- Unconfined Aquifer Hydrologic Test Data Package for the 200 East Groundwater Aggregate Area

- Confined Aquifer Hydrologic Test Data Package for the 200 Groundwater Aggregate Area Management Studies

- Groundwater Field Characterization Report

- 200 West Area Borehole Geophysics Field Characterization

- 200 East Area Borehole Geophysics Field Characterization

The general scope of the topical reports related to this AAMSR is described in Section 8.0.

Information on waste sources, pathways, and receptors is used to develop a preliminary conceptual model of the aggregate area. In the preliminary conceptual model, the release mechanisms and transport pathways are identified. If the conceptual understanding of the site is considered inadequate, limited field characterization activities can be undertaken as part of the study. Field screening activities occurring in parallel with and as part of the AAMS process include the following:

- Expanded groundwater monitoring programs (non Contract Laboratory Program) at approximately 80 select existing wells to identify contaminants of concern and refine groundwater plume maps

- In situ assaying of gamma-emitting radionuclides at approximately 10 selected existing boreholes per aggregate area to develop radioelement concentration profiles in the vadose zone.

Wells, boreholes, and analytes are selected based on a review of existing environmental data which is undertaken early in the AAMS process. Field characterization results will be presented later in topical reports.

After the preliminary conceptual model is developed, health and environmental concerns are identified. The purpose of this determination is to provide one basis for determining recommendations and prioritization for subsequent actions at waste management units. Potential applicable or relevant and appropriate requirements (ARARs) and potential remedial technologies are identified. In cases where the existing information is sufficient, the *Hanford Site Past-Practice Strategy* allows for a focused feasibility study (FFS) or CMS to be initiated prior to the completion of the study.

Data needs are identified by evaluating the sufficiency of existing data and by determining what additional data are necessary to adequately characterize the aggregate area, refine the preliminary conceptual model and potential ARARs, and/or narrow the range of remedial alternatives. Determinations are made regarding the level of uncertainty associated with existing data and the need to verify or supplement the data. If additional data are needed, the intended data uses are identified, data quality objectives (DQO) established and data priorities set.

Each AAMSR results in management recommendations for the aggregate area including the following:

- The need for ERA, IRM, and LFI or whether to retain in the final remedy selection path
- Definition and prioritization of operable units
- Prioritization of work plan activities
- Integration of RCRA TSD closure activities
- The conduct of field characterization activities
- The need for treatability studies.
- Identification of waste management units addressed entirely under other operational programs

The waste management units recommended for ERA, IRM, or LFI actions are considered higher priority units that require rapid response. Lower priority waste management units will generally follow the conventional process for RI/FS. In spite of this distinction in the priority of sites, RI/FS activities will be conducted for all the waste management units. In the case of the higher priority waste management units, rapid response operations will be followed by conventional RI/FS activities, although these activities may be modified because of knowledge gained through the remediation activities. In the case of the lower priority waste management units, an area-wide RI/FS will be prepared which encompasses these sites.

Based on the AAMSR, a decision is made on whether the study has provided sufficient information to forego further field investigations and prepare a FS. An RI/FS work plan (which may be limited to LFI activities) will be developed and executed. The background information normally required to support the preparation of a work plan (e.g., site description, conceptual model, DQO, etc.) is developed in the AAMSR. The future work plans will reference information from the AAMSR. They will also include the rationale for sampling and analysis, will present detailed, unit-specific DQO, and will further develop physical site models as the data allows. In some cases, there may be insufficient data to support any further analysis than is provided in the AAMSR, so an added level of detail in the work plan may not be feasible.

All ten AAMS are scheduled to be completed by September 1992. This will facilitate a coordinated approach to prioritizing and implementing future past practice activities for the entire 200 Areas.

1.3 PURPOSE, SCOPE, AND OBJECTIVES

The purpose of conducting an AAMS is to compile and evaluate the existing body of knowledge and conduct limited field characterization work to support the *Hanford Site Past-Practice Strategy* decision making process for an aggregate area. The AAMS process is similar in nature to the RI/FS scoping process prior to work plan development and is intended to maximize the use of existing data to allow a more limited and focused RI/FS. Deliverables for an AAMS consist of the AAMSR and health and safety, project management, and data management plans.

Specific objectives of the AAMS include the following:

- Assemble and interpret existing data including operational and environmental data
- Describe site conditions
- Conduct limited new site characterization work if data or interpretation uncertainty could be reduced by the work
- Develop a preliminary conceptual model
- Identify contaminants of concern, and their distribution

- Identify potential ARARs

- Define preliminary remedial action objectives (RAOs), screen potential remedial technologies, and if possible provide recommendations for FFS

- Recommend treatability studies to support the evaluation of remedial action alternatives

- Define data needs, establish general DQO and set data priorities

- Provide recommendations for ERA, IRM, LFI or other actions

- Redefine and prioritize, as data allow, operable unit boundaries

- Define and prioritize, as data allow, work plan and other past practice activities with emphasis on supporting early cleanup actions and records of decisions

- Integrate RCRA TSD closure activities with past practice activities.

Information on single-shell and double-shell tanks is presented in Sections 2.0 and 4.0. The AAMSR is not intended to address remediation related to the tanks. Nonetheless, the tank information is presented because known and suspected releases from the tanks may influence the interpretation of contamination data at nearby waste management units. Information on other facilities and buildings is also presented for this same reason. However, because these structures are addressed by other programs, the AAMSR does not include recommendations for further action at these structures.

Depending on whether an aggregate area is a source or groundwater aggregate area, the scope of the AAMS varies. Source AAMS focus on source terms, and the environmental media of interest include air, biota, surface water, surface soil, and the unsaturated subsurface soil. Accordingly, detailed descriptions of facilities and operational information are provided in the source AAMSR. In contrast, groundwater AAMS focus on the saturated subsurface and on groundwater contamination data. Descriptions of facilities in the groundwater AAMSR are limited to liquid disposal facilities and reference is made to source AAMSR for detailed descriptions. The description of site conditions in source AAMSR concentrate on site physiography, meteorology, surface water hydrology, vadose zone geology, ecology, and demography. Groundwater AAMSR summarize regional geohydrologic conditions and contain detailed information regarding the local geohydrology on an Area-wide scale. Correspondingly, other sections of the AAMSR vary depending on the environmental media of concern.

1.4 QUALITY ASSURANCE

A limited amount of field characterization work is performed in parallel with preparation of the AAMS report. To help ensure that data collected are of sufficient quality to support decisions, all work will be performed in compliance with Westinghouse Hanford's existing QA manual, WHC-CM-4-2 (WHC 1988a) and with procedures outlined in the QA program plan, WHC-EP-0383 (WHC 1990) specific to CERCLA RI/FS activities. This QA program plan describes the various plans, procedures, and instructions that will be used by Westinghouse Hanford to implement the QA requirements.

1.5 ORGANIZATION OF REPORT

In addition to this introduction, the AAMSR consists of the following nine sections and appendices:

- Section 2.0, Facility, Process and Operational History Descriptions, describes the major facilities, waste management units and unplanned releases within the aggregate area. A chronology of waste disposal activities is established and waste generating processes are summarized.

- Section 3.0, Site Conditions, describes the physical, environmental, and sociological setting including, geology, hydrology, ecology, meteorology, and demography.

- Section 4.0, Preliminary Conceptual Model, summarizes the conceptual understanding of the aggregate area with respect to types and extent of contamination, exposure pathways and receptors.

- Section 5.0, Health and Environmental Concerns, identifies chemicals used or disposed within the aggregate area that could be of concern regarding public health and/or the environment and describes and applies the screening process for determining the relative priority of follow-up action at each waste management unit.

- Section 6.0, Potentially Applicable or Relevant and Appropriate Requirements, identifies federal and state standards, requirements, criteria, or limitations that may be considered relevant to the aggregate area.

- Section 7.0, Preliminary Remedial Action Technologies, identifies and screens potential remedial technologies and establishes remedial action objectives for environmental media.

- Section 8.0, Data Quality Objectives, reviews QA criteria on existing data, identifies data gaps or deficiencies, and identifies broad data needs for field characterization and risk assessment. The DQO and data priorities are established.

- Section 9.0, Recommendations, provides guidance for future past practice activities based on the results of the AAMS. Recommendations are provided for ERA at problem sites, IRM, LFI, refining operable unit boundaries, prioritizing work plans, and conducting field investigations and treatability studies.

- Section 10.0, References, list reports and documents cited in the AAMSR.
- Appendix A, Supplemental Data, provides supplemental data supporting the AAMSR.

The following plans are included and will be used to support past practice activities in the aggregate area:

- Appendix B: Health and Safety Plan

- Appendix C: Project Management Plan

- Appendix D: Data Management Plan

Community relations requirements for the B Plant Aggregate Area can be found in the *Community Relations Plan for the Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989).

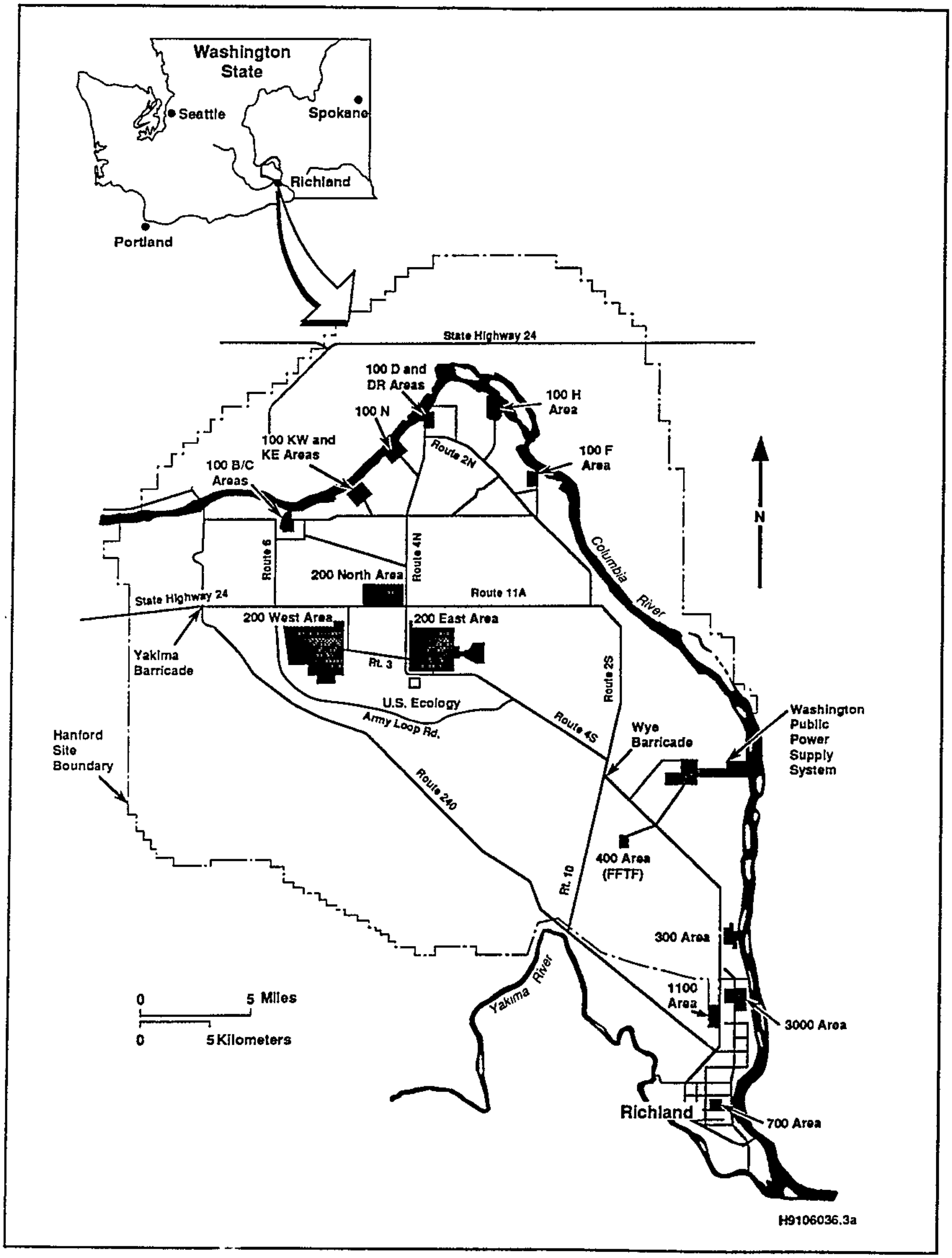


Figure 1-1. Hanford Site Map.

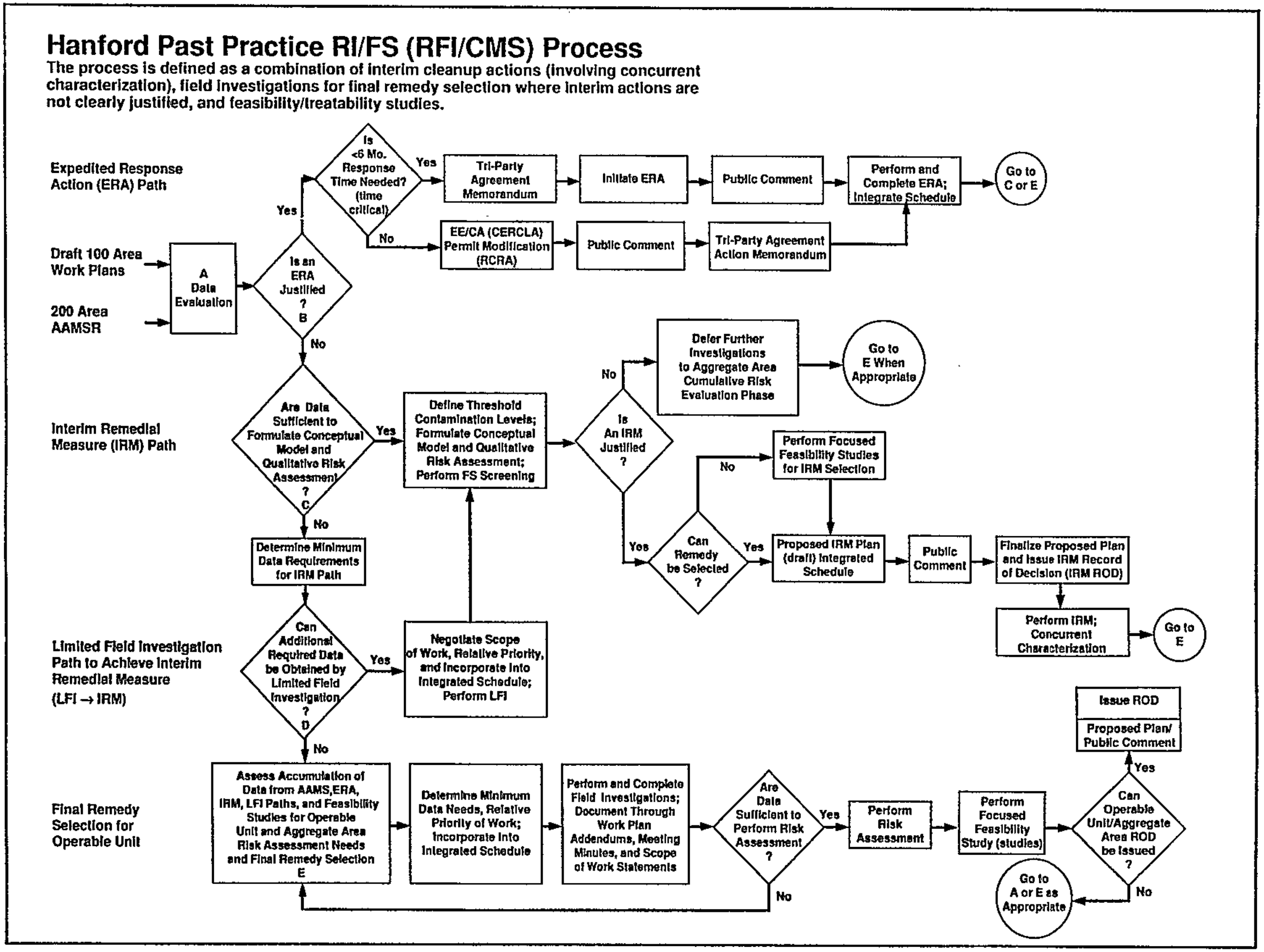


Figure 1-2. Hanford Past Practice Strategy Flow Chart. (DOE/RL 1992a)

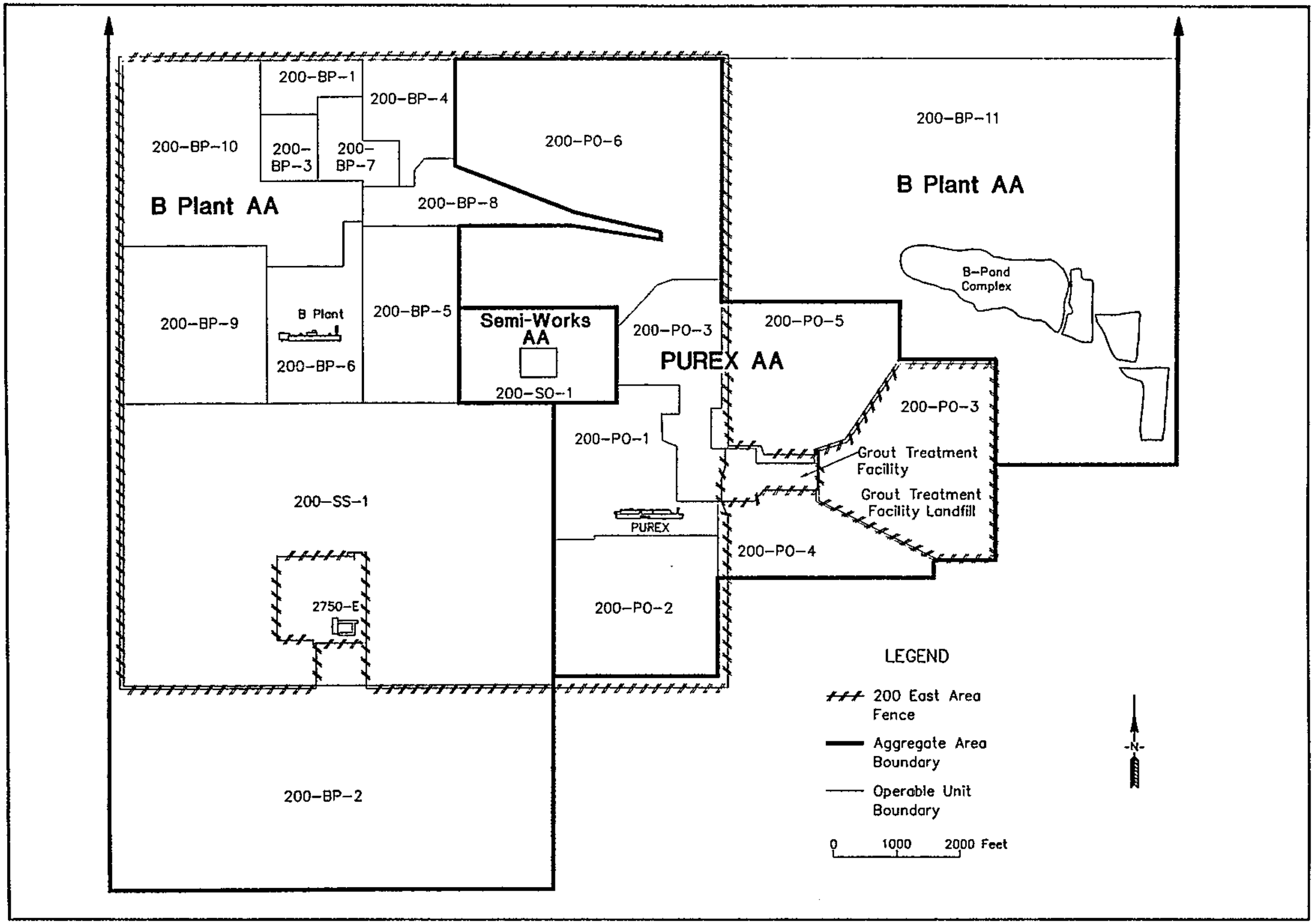


Figure 1-3. 200 East Aggregate Areas.

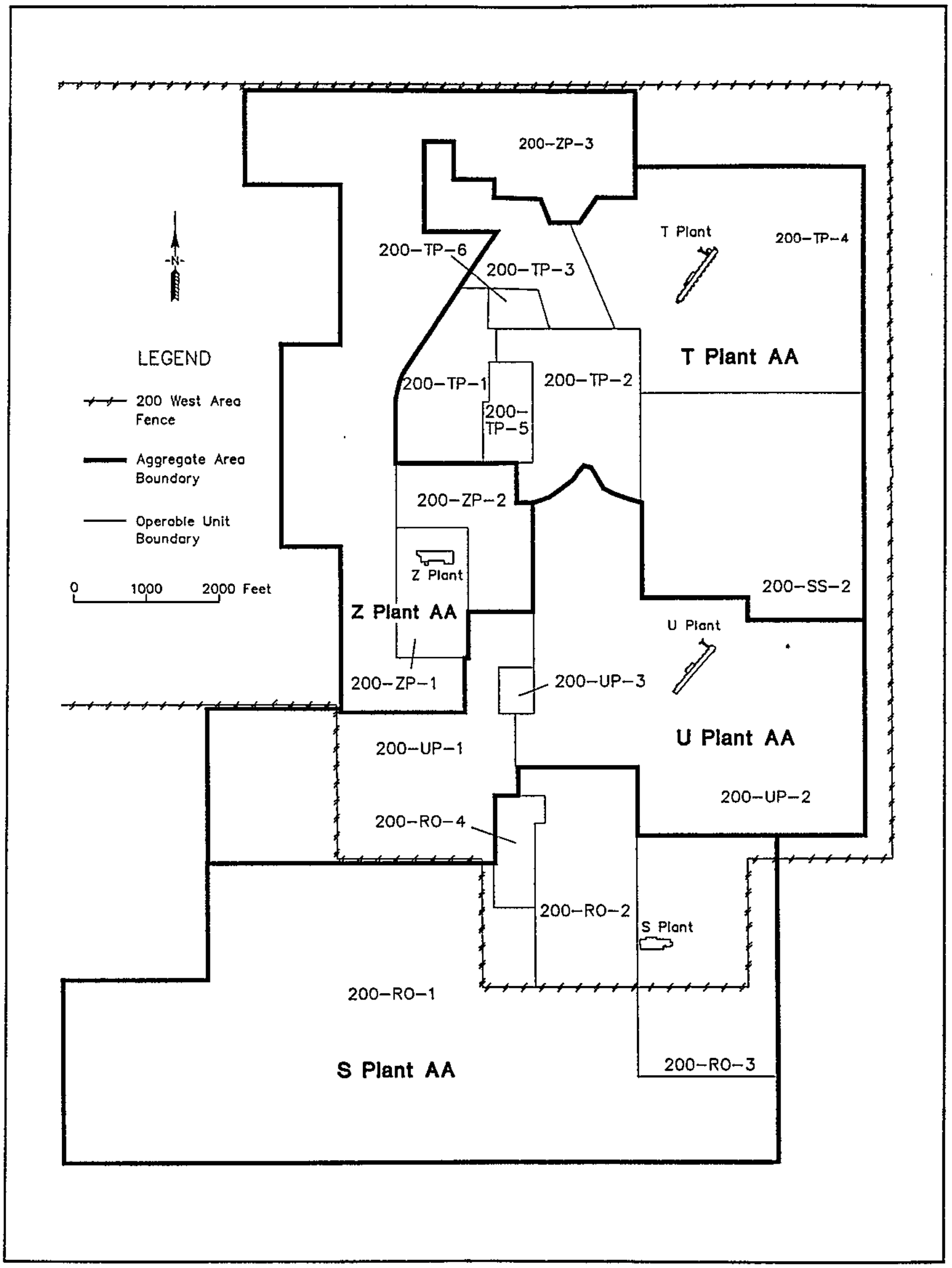


Figure 1-4. 200 West Aggregate Areas.

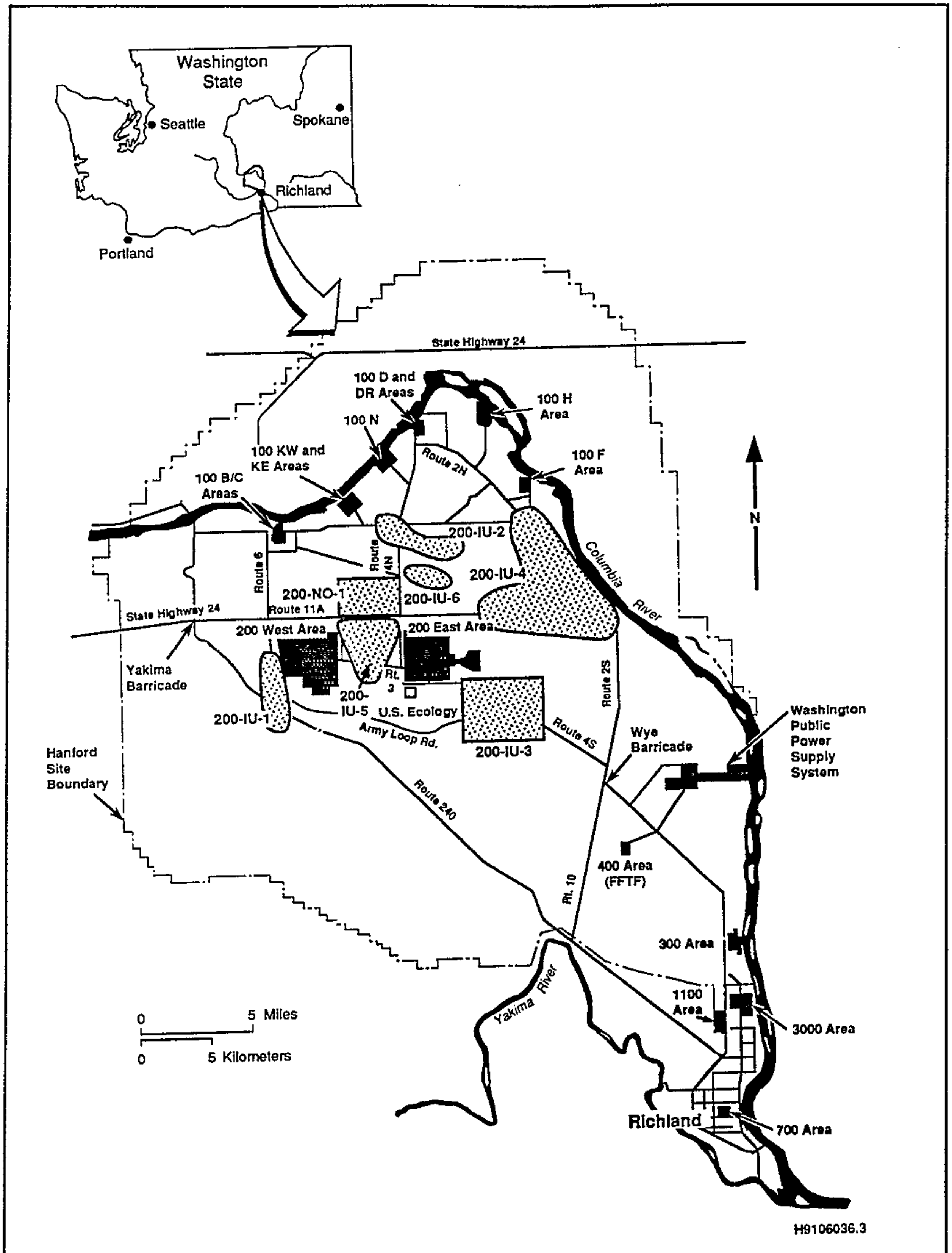


Figure 1-5. 200 NPL Site Isolated Operable Units.

Table 1-1. Overall Aggregate Area Management Study (AAMS) Schedule for the 200 NPL Site.

AAMS Title	Operable Units	AAMS Type	Lead Regulatory Agency	M-27-00 Interim Milestones
U Plant	200-UP-1 200-UP-2 200-UP-3	Source	Ecology	M-27-02, January 1992
Z Plant	200-ZP-1 200-ZP-2 200-ZP-3	Source	EPA	M-27-03, February 1992
S Plant	200-RO-1 200-RO-2 200-RO-3 200-RO-4	Source	Ecology	M-27-04, March 1992
T Plant	200-TP-1 200-TP-2 200-TP-3 200-TP-4 200-TP-5 200-TP-6 S00-SS-2	Source	EPA	M-27-05, April 1992
PUREX	200-PO-1 200-PO-2 200-PO-3 200-PO-4 200-PO-5 200-PO-6	Source	Ecology	M-27-06, May 1992
B Plant	200-BP-1 200-BP-2 200-BP-3 200-BP-4 200-BP-5 200-BP-6 200-BP-7 200-BP-8 200-BP-9 200-BP-10 200-BP-11 200-IU-6 200-SS-1	Source	EPA	M-27-07, June 1992
Semi-Works	200-SO-1	Source	Ecology	M-27-08, July 1992
200 North	200-NO-1	Source	EPA	M-27-09, August 1992
200 West	NA	Groundwater	EPA/Ecology	M-27-10, September 1992
200 East	NA	Groundwater	EPA/Ecology	M-27-11, September 1992

2.0 FACILITY, PROCESS AND OPERATIONAL HISTORY DESCRIPTIONS

Section 2.0 of the aggregate area management study (AAMS) presents historical data on the B Plant Aggregate Area and detailed physical descriptions of the individual waste management units and unplanned releases. These descriptions include historical data on waste sources and disposal practices and are based on a review of current and historical Hanford Site reports, engineering drawings, site inspections, and employee interviews. Section 3.0 describes the environmental setting of the waste management units. The waste types and volumes are qualitatively and quantitatively assessed at each site in Section 4.0. Data from these three sections are used to identify contaminants and sites of concern (Section 5.0), potential applicable or relevant and appropriate requirements (ARARs) (Section 6.0), and current data gaps (Section 8.0).

This section describes the location of the B Plant Aggregate Area (Section 2.1), summarizes the history of operations (Section 2.2), describes facilities, buildings, and structures of the B Plant Aggregate Area (Section 2.3), and describes B Plant Aggregate Area waste generating processes (Section 2.4). Section 2.5 discusses interactions with the other aggregate areas or operable units. Section 2.6 and 2.7 discuss interactions with the Resource Conservation and Recovery Act (RCRA) program and other Hanford programs.

2.1 LOCATION

The Hanford Site, operated by the U.S. Department of Energy (DOE), occupies about 1,450 km^2 (560 mi^2) of the southeastern part of Washington State north of the confluence of the Yakima and Columbia Rivers (Figure 1-1). The 200 East Area is a controlled area of approximately 15 km^2 (6 mi^2) near the middle of the Hanford Site. The 200 East Area is about 10 km (6 mi) from the Columbia River and 20 km (12 mi) from the nearest Hanford boundary. There are 20 operable units grouped into three aggregate areas in the 200 East Area (Figure 1-4). The B Plant Aggregate Area (consisting of operable units 200-BP-1 through 200-BP-11, 200-SS-1, and 200-IU-6) lies in the northeast and northcentral parts of the 200 East Area, and south of the 200 East Area (Figure 1-3). The locations of the buildings and waste management units are shown on Plate 1. Plate 2 shows the topography of the B Plant Aggregate Area. The media sampling locations are depicted on Plate 3.

2.2 HISTORY OF OPERATIONS

The Hanford Site, established in 1943, was originally designed, built, and operated to produce plutonium for nuclear weapons using production reactors and chemical reprocessing plants. In March 1943, construction began on three reactor facilities and three chemical processing facilities. After World War II, six more reactors were built. Beginning in the 1950's, waste management, energy research and development, isotope use, and other activities were added to the Hanford operation. In early 1964, a presidential decision was made to begin shut down of the reactors. Eight of the reactors were shut down by 1971. The N Reactor continued to operate primarily in weapons grade material production mode through 1987; operated secondarily in steam production mode for electricity production; and was placed on cold standby status in October 1989. Westinghouse Hanford was notified September 20, 1991 that they should cease preservation and proceed with activities leading to a decision on ultimate decommissioning of the reactor. These activities are scoped within a N Reactor shutdown program which is scheduled to be completed in 1999.

Operations in the 200 Areas (East and West) are mainly related to nuclear fuel separation. Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation. The 200 East Area consists of two main processing areas (Figure 1-4):

- 221-B Building (B Plant), where bismuth phosphate processes separated plutonium from spent uranium fuel rods

- 202-A Building (PUREX) Plant, where tributyl phosphate processes separate plutonium from spent uranium fuel rods

- C Plant (Hot Semiworks), where plutonium separation technology was developed (no longer in use).

The 200 Areas also contain nonradioactive support facilities, including transportation maintenance buildings, service stations, coal-fired powerhouses for process steam production, steam transmission lines, raw water treatment plants, water-storage tanks, electrical maintenance facilities, and subsurface sewage disposal systems.

The major processes at the B Plant Aggregate Area involved extraction of plutonium from nuclear fuels; purification, precipitation, and encapsulation of cesium and strontium from PUREX-derived waste streams; various waste handling processes, such as evaporation and transfer of single-shell tank waste.

The 221-B Building is one of the primary B Plant Aggregate Area facilities. It began operation in 1945, separating plutonium by bismuth phosphate chemical methods. It ceased operation in 1952, then began various waste treatment operations in 1965. Several additions to the 221-B Building, such as the 225-B Waste Encapsulation and Storage Facility (WESF), the 212-B Cask Transfer Facility, etc. were constructed during this period.

Waste evaporators and in-tank solidification units have been used in the 241-B, 241-BX, and 241-BY Tank Farms to minimize the volume of tanked waste. Also, some B Plant Aggregate Area tank wastes were transferred to the U Plant Aggregate Area for uranium recovery, then returned to the B Plant Aggregate Area and disposed to the ground.

2.3 FACILITIES, BUILDINGS, AND STRUCTURES

The B Plant Aggregate Area contains a large variety of waste disposal and storage facilities that were associated with B Plant missions. High-level liquid wastes were stored in underground tanks while low-level liquid wastes were allowed to infiltrate into the ground through cribs, french drains, reverse wells, ponds, and open ditches. These waste types are defined in DOE Order 5820.2A (DOE 1988a):

- High-level waste is defined as: highly radioactive material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic (TRU) waste and fission products in concentrations as to require permanent isolation.

- TRU waste is defined as: without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Heads of Field Elements can determine that other alpha contaminated wastes peculiar to a specific site, must be managed as TRU waste.

- Low-Level Waste is defined as: Waste that contains radioactivity and is not classified as high-level waste, TRU waste, or spent nuclear fuel, or 11e(2) byproduct material as defined by this Order. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of TRU is less than 100 nCi/g.

- Byproduct Material is defined as: (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident or to the process of producing or utilizing special nuclear material. For purposes of determining the applicability of the Resource Conservation and Recovery Act to any radioactive waste, the term "any radioactive material" refers only to the actual radionuclides dispersed or suspended in the waste substance. The nonradioactive hazardous waste component of the waste substance will be subject to regulation under the Resource Conservation and Recovery Act.

(b) The tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Ore bodies depleted by uranium solution extraction operations and which remain underground do not constitute "byproduct material."

Based on construction, purpose, or origin, the B Plant Aggregate Area waste management units fall into one of ten subgroups as follows:

- Plants, Buildings, and Storage Areas (Section 2.3.1)
- Tanks and Vaults (Section 2.3.2)
- Cribs and Drains (Section 2.3.3)
- Reverse Wells (Section 2.3.4)
- Ponds, Ditches, and Trenches (Section 2.3.5)
- Septic Tanks and Associated Drain Fields (Section 2.3.6)
- Transfer Facilities, Diversion Boxes, and Pipelines (Section 2.3.7)
- Basins (Section 2.3.8)
- Burial Sites (Section 2.3.9)
- Unplanned Releases (Section 2.3.10)

Table 2-1 presents a list of the waste management units within the aggregate area. In addition, the area contains several unplanned release sites. The locations of waste management units are shown on separate figures for each waste management group and Plate 1. Table 2-2 describes the B Plant Aggregate Area tank farms. Tables 2-3 and 2-4 summarize data available regarding the quantity and types of wastes disposed to the waste management units. These data have been compiled from the Waste Information Data System (WIDS) inventory sheets (WHC 1991a) and from the Hanford Inactive Site Survey (HISS) database, and other sources found during research. These inventories include all of the contaminants reported in the databases, but do not necessarily include all of the contaminants disposed of at each waste management unit. Figures 2-1 through 2-13 show the physical location of the waste management units. Timelines for B Plant Aggregate Area operating processes are shown on Figure 2-14. Figures 2-15 and 2-16 schematically show the B Plant Aggregate Area processes. Figure 2-17 shows waste management unit operational history.

Figure 2-18 shows the operational history for the 216-B-3 Pond System. Figures 2-19 through 2-26 show representative construction details about individual waste management units.

In the following sections, each waste management unit is described within the context of one of the waste management unit types. Unplanned release numbers preceded by UPR indicate that the release is directly associated with a pre-existing waste management unit. An unplanned release identification number beginning with UN indicates the release affected areas that were previously undocumented.

2.3.1 Plants, Buildings, and Storage Areas

Plants and buildings are not generally identified as past practice waste management units according to the *Hanford Federal Facility Agreement and Consent Order* (Tri-party Agreement), and will generally be addressed under the decontamination and decommissioning program. Several of the B Plant Aggregate Area plants or buildings were the primary generators of waste disposed of within the B Plant Aggregate Area. A description of the plants and buildings is provided in Section 2.3.1.1. The B Plant Aggregate Area plants and buildings that are also waste management units are addressed in Section 2.3.1.2. Some plants and buildings are or contain RCRA treatment, storage, or disposal (TSD) facilities, which are described in Section 2.6. The locations of plants, buildings, and storage areas in the aggregate area are shown on Figure 2-1.

The 221-B Building, the 222-B Building, the 224-B Building, and the 225-B Building were the primary generators of waste that are within the aggregate area. These plants, and the buildings associated with them, will be described in the following sections.

Other buildings and structures located within the aggregate area are not addressed in this document because they are not thought to have released contaminants and will be closed through a separate decontamination and decommissioning process. The decontamination and decommissioning program will address both contaminated and uncontaminated structures and is described in the *Hanford Surplus Facilities Program Plan* (Hughes et al. 1990). These structures include:

- 212-B Cask Transfer Facility (receives/ships batch quantities of feed product)
- 211-B Chemical Tank Farm (bulk storage area)
- 2711-E Vehicle Maintenance Shop.

Buildings and structures which lie outside of the B Plant Aggregate Area as shown on Figure 1-3 are not considered in this report.

2.3.1.1 Process Facilities.

2.3.1.1.1 221-B Building (B Plant). The 221-B Building (B Plant) was one of the primary sources of waste in the B Plant Aggregate Area and is the dominant physical structure in the area.

The 221-B Building was constructed in 1944, and brought on line in 1945, as one of the three original chemical separation plants (B, T, and U Plants) to support plutonium production during World War II. The plants were built to extract plutonium from fuel rods irradiated in the Hanford production reactors. Each plant was equipped to use the bismuth phosphate fuels-separation process, but U Plant was never used for that purpose because B Plant and T Plant were sufficient to meet plutonium production needs.

The 221-B Building is 267 x 26 x 31 m (875 x 85 x 102 ft) and is constructed entirely of concrete. Its process equipment is contained in small rooms, called cells, which are arranged in rows in an area spanned by a traveling crane. The cells are topped with 1.2 m (4 ft) thick concrete blocks that are removable by crane to provide access to the cell beneath. Above the blocks is a space equal in height to the cell depth providing headroom for manipulating the process equipment during maintenance operations. Heavy concrete shielding walls enclose this space up to the level of the crane rails, giving the appearance of a canyon (Ballinger and Hall 1991). The 221-B Building also encompasses several adjoining structures such as the 221-BB Condensate Building, the 221-BF Effluent Control Building, and the 221-BC Change House.

Plutonium separation began with the dissolution of the aluminum-jacketed fuel rods in a sodium hydroxide solution to which sodium nitrate was added to avoid formation of too much hydrogen. The resulting sodium aluminate-sodium nitrate solution was jetted (transferred via a steam jet) to waste as a component of the first cycle waste stream.

The remaining uranium metal slugs were rinsed with water and dissolved in 50 to 60% nitric acid. Sodium and bismuth nitrate and phosphoric acid were added to the dissolver solution, precipitating bismuth phosphate, which carried the plutonium. The solution was jetted to waste (the metal waste stream), and the precipitate was again dissolved in nitric acid. Dichromate solution was added to the sodium and bismuth nitrate and phosphoric acid, again precipitating bismuth phosphate, but changing the valence of the plutonium and causing it to remain in solution. The byproduct cake was dissolved in nitric acid and jetted to waste. The product solution was again treated to precipitate bismuth phosphate as the plutonium carrier, completing the "first decontamination cycle." The entire process was repeated, comprising the "second decontamination cycle" (Ballinger and Hall 1991).

The product from this process was a dilute plutonium solution that was transferred to the 224-B Building (Concentration Facility) where it was purified and its volume reduced. It was then transferred to the Isolation Building for final treatment before being shipped offsite (Ballinger and Hall 1991).

The coating removal waste, containing small amounts of fission products, was combined with first-cycle decontamination waste for storage in underground tanks as first cycle waste. Byproduct cake solution and waste solution from the first decontamination waste cycle contained about 10% of the original fission activity and 1% of the plutonium (Anderson 1990).

Metal waste contained all of the uranium, approximately 90% of the original fission products activity, and approximately 1% of the product. This waste was neutralized with 50% caustic and treated with an excess of sodium carbonate, then was sent to underground tanks (Anderson 1990; Ballinger and Hall 1991).

Second decontamination-cycle waste contained less than 0.1% of the fission product activity and about 1% of the plutonium. Stack drainage, initially combined with second-cycle waste, was combined with first decontamination-cycle waste in May 1951 (Anderson 1990).

2.3.1.1.2 224-B Concentration Facility. The 224-B Concentration Facility was used as a plutonium concentration facility. In it, the dilute plutonium nitrate solutions were purified, and the plutonium carrier changed from nitrate to lanthanum fluoride. The facility is 60 m (197 ft) long, 18 m (60 ft) wide, and 21 m (70 ft) high, and contains radioactive equipment and concrete. Hazardous constituents include mercury, polychlorinated biphenyls (PCBs), residual cleaning chemicals, and radionuclides consisting of about 35 Ci of plutonium, 5.2 Ci of ^{241}Am, 2.1 Ci of ^{90}Sr, 3.6 Ci of ^{60}Co, and 1 Ci of ^{137}Cs. The 224-B Concentration Facility has "Radiologically Controlled Area" and "Radioactive Material" warning signs on every door.

2.3.1.1.3 222-B Laboratory. The 222-B Laboratory located directly southeast of the 221-B Building was used from 1945 until 1952 for laboratory analysis in support of the B Plant Bismuth Phosphate Fuel Processing. Various small scale experiments were done inside the facility. The 222-B Laboratory is within the B Plant Aggregate Area and is a source of wastes, but it will be addressed under a separate decommissioning and decontamination program. This facility disposed of liquid waste to the 216-B-6 Reverse Well and the 216-B-10A Crib.

2.3.1.1.4 225-B Building. The 225-B Building is physically attached to the west end of the 221-B building. It covers an area of approximately 6,000 m^2 (60,000 ft^2) and contains process cells similar to the cells in the 221-B Building. It was constructed in 1974 and contains thick concrete outer walls which provide shielding for radioactive materials. The building was built to house the processing systems needed to encapsulate recovered cesium and strontium and safely store the encapsulated material.

2.3.1.1.5 291-B Building. The 291-B Building consists of air filter systems, ventilation equipment, and an exhaust stack. It is located east of the 222-B Building and south of the 221-B Building. The equipment contained within this complex is used to collect and filter air from the 221-B Building before discharging it to the exhaust stack. Radioactive contaminants were present in the exhaust air as a result of the various dissolving steps during the fuel processing. The principal contaminants were ^{131}I and krypton and xenon isotopes.

The airborne contaminants were removed with a variety of technologies that were implemented during the fuel processing operational period of B Plant from 1945 to 1952. Initially, sand filters were installed to filter out airborne particulate contaminants. Water scrubbers were installed in 1948 to reduce radioactive iodine concentrations in radioactive particles. In 1950, silver reactors were installed to further reduce ^{131}I emissions. With this system, the gases from the fuel dissolving process (See Section 2.4.1) were heated to 230 °C (446 °F) and passed over a ceramic packing coated with fused silver nitrate. The iodine was removed by the formation of silver iodide on the ceramic packing. The hot gases were then filtered through a fine fiberglass mat. The 291-B Building is within the B Plant Aggregate Area and is a source of wastes, but it will be addressed under a separate decommissioning and decontamination program. This facility disposed of liquid waste to the 216-B-4 Reverse Well and the 216-B-13 French Drain.

2.3.1.1.6 292-B Building. The 292-B Building contained laboratory equipment used in connection with the operation of the exhaust gas processing equipment for the 291-B Building. The 292-B Building is located between the 291-B Building and the 222-B Building. The 292-B Building is within the B Plant Aggregate Area and is a source of wastes, but it will be addressed under a separate decommissioning and decontamination program. This facility disposed of liquid waste to the 216-B-4 Reverse Well.

2.3.1.1.7 242-B Building. The 242-B Building contains the 242-B Evaporator and is located immediately south of the 241-B Tank Farm. The 242-B Building is within the B Plant Aggregate Area and is a source of wastes, but it will be addressed under a separate decommissioning and decontamination program. This facility disposed of liquid waste to the 216-B-11A and 216-B-11B Reverse Wells and the 216-B-37 Trench.

2.3.1.1.8 284-E Powerhouse. The 284-E Powerplant facility consists of the 284-E Powerplant building and its associated boilers and machinery. Operation of the 284-E Powerhouse produces three wastewater streams: wastewater from routine operations, water softener wastewater, and boiler blowdown (WHC 1990a). This effluent is discharged to the 216-B-3 Pond system through the 216-B-3-3 Ditch.

Of the three contributors to the 284-E Powerhouse wastewater stream, the routine operations contributor is the largest. The sources for it are wastewaters from cooling operations within the powerplant. The cooling water is used for air compressors, turbines, generators, boiler water jackets, and feed pumps. It has a constant flow discharge and averages 12,300,000 L/month (3,250,000 gal/month). The other two contributing streams are discharges from batch processes. In the water softening process, a brine solution is used to regenerate zeolite water softener units. The softener regeneration operation produces the waste stream with the highest concentration of dissolved solids of approximately nine weight percent in sodium chloride. The flowrate for the softener regeneration is 1,140,000 L/month (300,000 gal/month). The effluent contribution due to boiler blowdown contains boiler treatment chemicals and has an average discharge of 378,000 L/month (100,000 gal/month) (WHC 1990a).

2.3.1.1.9 283-E Water Treatment Facility. The 283-E Water Treatment Facility purifies and treats Columbia River water and produces potable water for the 200 East Area. The raw water is pumped from the 100-B Area River Pumphouse and enters a reservoir near the 284-E Powerhouse where it is stored before being treated with alum and chlorine. After settling, the water is routed through a filter for the final purification. The filter layers consist of porcelain beads, gravel, sand, and anthracite coal (DOE/RL 1990b). Overflow water from the treatment steps is discharged to the 216-B-3 Pond System through the 216-B-3-3 Ditch.

2.3.1.1.10 2101-M Building. The 2101-M Building, shown in Figure 2-1, was constructed in 1953. It is a single-story building constructed with steel panels and beams on a concrete foundation. It has a concrete floor and a built-up asphalt and gravel roof (WHC 1990c). Different areas in the building are used for different purposes, such as soil testing laboratories, a spare parts warehouse, craft shops, and offices. Most of the spaces in the building are environmentally controlled by evaporative cooling and steam heating.

The 2101-M Building is serviced by an (8 in.) diameter sanitary water line. Other services include steam, a compressed air system, and a ventilation system. The drains in the laboratories have been either physically sealed or have administrative controls in place to stop chemical discharges from them to the soil column. Most of the effluent is from the heating, ventilation, and air conditioning system of the building. Sanitary effluents from the 2101-M Building are discharged to a septic tank sanitary sewer system. Cooling water, steam condensate, and evaporative cooling overflow water is discharged to the 2101-M Pond (WHC 1990c).

2.3.1.1.11 272-E Metal Shop. The 272-E Metal Shop is located approximately 1/2 mile south of the 221-B Building, near the 2711-E Vehicle Maintenance Shop. The metal shop may have discharged cutting oils and waste metals to the 2607-E7-B septic tank and to the chemical tile field north of 2703-E Hazardous Waste Storage Area. Little information is available about this site.

2.3.1.1.12 2703 Chemical Engineering Laboratory Building. The 2703 Chemical Engineering Laboratory Building is located approximately 1/2 mile south of the 221-B Building. Nonhazardous effluents from the laboratory building are disposed of at the chemical tile field north of the 2703-E Hazardous Waste Storage Area.

2.3.1.2 Waste Management Unit Buildings.

2.3.1.2.1 226-B Hazardous Waste Staging Area. The 226-B Hazardous Waste Staging Area (HWSA) is located north of the 221-B Building and is an active waste management unit for temporary storage of hazardous materials. Typical wastes contained in storage area over the past year include about 184 kg (406 lb) of halogenated hydrocarbons, 2,200 kg (4,850 lb) of sodium hydroxide and alkaline liquids, 800 kg (1,764 lb) of antifreeze, 1.84 kg (4,061 lb) of acids, 580 kg (1,279 lb) of miscellaneous toxic process chemicals, 1,155 kg (2,546 lb) of methyl ethyl ketone and flammable solvents. The 226-B HWSA consists of a concrete pad surrounded by a light chain barricade. The unit is labeled "226-B hazardous waste 90 day staging area" and "PCB 30 day storage."

2.3.1.2.2 2703-E Hazardous Waste Staging Area. Liquid hazardous waste is temporarily stored on an asphalt pad at the 2703-E HWSA before burial. Typical waste held in the staging area includes about 11,126 kg (24,529 lb) of alkaline liquids and sodium hydroxide, 500 kg (1,102 lb) of sodium dichromate containing process solutions, and 415 kg (915 lb) of waste acids.

2.3.1.2.3 2704-E Hazardous Waste Staging Area. The 2704-E HWSA is listed as an active unit in the *Hanford Site Waste Management Units Report* (DOE/RL 1991a), used for temporary storage of hazardous materials. It is listed as an asphalt pad, and is located adjacent to the 2711-E Garage and across the street from the former 2704-E Building. Typical wastes stored there have included antifreeze, grease, diesel fuel, and asphalt.

2.3.1.2.4 2715-EA Hazardous Waste Staging Area. Waste containers consisting of waste paint and thinning solvents are temporarily stored at this facility. The 2715-EA

HWSA became operational in November 1984. Weekly documented inspections are performed by plant personnel.

The 2715-EA HWSA is a metal shed with a chain link fence as the front wall. A metal sign on the fence denotes site identification. Adjacent to the west side of the shed are two conex boxes and two chain-link fenced areas used as additional storage space.

2.3.2 Tanks and Vaults

Tanks and vaults were constructed to handle and store liquid wastes generated by plutonium processing. The types of tanks present in the aggregate area include large, single-shell storage tanks, catch tanks that drain diversion boxes, settling tanks, vaults, and siphon tanks.

The primary tank facilities in the aggregate area are the 241-B, 241-BX, and 241-BY Tank Farms. All of the single-shell tanks will be addressed by the Hanford Site Single-Shell Tank Closure Program. The structure and the related contamination in the tank farm will be described in this AAMS report, but investigation and remediation strategies will be deferred to the Hanford Site Single-Shell Tank Closure Program. A summary of tank farm status can be found in Table 2-2. The location of all tanks and vaults in the B Plant Aggregate Area are shown on Figures 2-2 and 2-3.

The 241-B and 241-BY Tank Farms received non-boiling wastes from the 221-B Building. The 241-BX Tank Farm was constructed to receive bismuth phosphate metal waste, 221-B Building low-level waste, ion exchange waste (B Plant waste fractionization), reduction-oxidation (REDOX) ion exchange waste, and other less voluminous wastes. The 241-BX and -BY Tank Farms were constructed when the 241-B Tank Farm became 100% full in 1946.

The tanks in each tank farm are arranged in groups of three and were designed to use the settling cascade concept. With this concept, sediment in the waste stream settled in the bottom of the first tank of the cascade series before the waste stream overflowed to the second tank. Additional sediment dropped out in the second tank before the waste stream overflowed to the third tank which allowed more settling (e.g., the flow sequence was 101 to 102 to 103, 104 to 105 to 106, 107 to 108 to 109, and 110 to 111 to 112). The 208,000 L (55,000 gal) capacity tanks in the 241-B Tank Farm were not in the cascade series (Jungfleisch 1984). Most of the radionuclides accumulated in the sludge that formed in the bottoms of the tanks. To prevent radiogenic heating of the waste, air cooled reflux condensers were installed to return the condensate to the tank and vent the non-condensable gases to the atmosphere.

Section 2.4 describes the processes that have produced the waste in the B Plant Aggregate Area tanks. Several methods have been used to evaporate the tank contents to reduce the volume of waste. Section 2.4 describes the operation of the In-Tank Solidification (ITS) -1 and -2 Evaporators and the 242-B Evaporator.

Interim isolation and stabilization have been performed on the tanks to varying degrees, as described in the descriptions of individual tanks. Interim isolation is the sealing of all accesses to the tank that are not required for long-term surveillance. The seal should provide a barrier against inadvertent addition of liquid. The administrative designation of partially interim isolated reflects the completion of the effort required for interim isolation with the exception of isolation of risers and piping required for pumping or other methods of stabilization (Hanlon 1992). Interim stabilization is the removal of as much liquid as possible through use of a salt well and a jet pump. A salt well is a slotted riser pipe inserted into the salt cake of a tank and into which a pump is placed. A tank is considered interim stabilized if it contains less than 189,000 L (50,000 gal) of drainable interstitial liquid and less than 19,000 L (5,000 gal) of supernatant liquid. In all cases of interim stabilization, interstitial liquids remain with the volume and vary according to waste volume, liquid type, and other factors.

2.3.2.1 241-B Tank Farm. The 241-B Tank Farm consists of a series of buried single-shell, carbon steel-lined, concrete reinforced tanks containing mixed waste. It is located about 800 m (2,600 ft) north northeast of the 221-B Building and covers approximately 11,000 m^2 (120,000 ft^2). The surface elevation is about 199 m (653 ft) above mean sea level (msl), and depth to groundwater is approximately 76 m (249 ft) below ground surface (Stalos and Walker 1977; WHC 1991a). There are 16 tanks in the 241-B Tank Farm. Twelve of the tanks have individual capacities of 2,017,000 L (533,000 gal) and are numbered 241-B-101 through -112. Four smaller tanks have capacities of 208,000 L (55,000 gal) and are numbered 214-B-201 through -204.

All twelve large tanks in the 241-B Tank Farm are constructed of a carbon steel liner in a reinforced concrete shell, 9 m (30 ft) high, with the bottom 11 m (37 ft) below grade. The tanks have a dished bottom and a 5 m (17 ft) operating height (DOE/RL 1991a). Each tank has a 2,017,000 L (533,000 gal) capacity and is inactive. The large tanks began service between 1945 and 1947 and most were used until about 1977. Figure 2-17 gives individual service dates. The four small tanks in the 241-B Tank Farm have a 208,000 L (55,000 gal) capacity. They are constructed of a carbon steel liner in a reinforced concrete shell, 8.8 m (29 ft) high, with the bottom 11 m (37 ft) below grade (DOE/RL 1991a). The small tanks began service in 1946 and most were used until 1977. See Figure 2-17 for individual tank service dates.

2.3.2.1.1 241-B-101 Single-Shell Tank. The 241-B-101 Single-Shell Tank has undergone initial stabilization and interim isolation (Hanlon 1992). It is an assumed leaker.

This tank contains bismuth phosphate metal waste; plutonium-extraction (PUREX) coating waste; 221-B Building concentrated waste from Cell 23; supernatant containing evaporator bottoms from the 241-B Tank Farms. Until February 1973, the unit provided storage for 221-B Building, Cell 23 evaporator bottoms, and waste enroute to ITS. The resulting solids remaining in this tank contain an estimated 4M Ci of strontium-90 (DOE/RL 1991a). This information has been gathered from core samples. Similar testing has not been done on other B Plant tanks.

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 428,000 L (113,000 gal) of sludge and 23,000 L (6,000 gal) of drainable interstitial liquid.

2.3.2.1.2 241-B-102 Single-Shell Tank. The 241-B-102 Single-Shell Tank has undergone initial stabilization and interim isolation and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; PUREX coating waste; supernatant containing 221-B Building low-level wastes, ion exchange waste, and evaporator bottoms from the 241-B, -BX, and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 38,000 L (10,000 gal) of salt cake, 68,000 L (18,000 gal) of sludge, 15,000 L (4,000 gal) of drainable interstitial liquid, and 15,000 L (4,000 gal) of supernatant.

While pumping supernatant from the 241-B-102 Single-Shell Tank to the 241-B-101, tank farm personnel noticed soil discoloration around the 241-B-102 Single-Shell Tank heel pit indicating a leak in the tank transfer line. Surface soil contamination with readings of 10 R/h were recorded. The contaminated ground area was immediately covered with asphalt to reduce radionuclide migration. This unplanned release is reported as UPR-200-E-108.

2.3.2.1.3 241-B-103 Single-Shell Tank. The 241-B-103 Single-Shell Tank has undergone initial stabilization and interim isolation and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate metal waste; PUREX coating waste; supernatant containing ion exchange waste, N Reactor waste, organic wash waste; Pacific Northwest Laboratory (PNL) waste, REDOX high-level waste, coating waste, evaporator bottoms, 221-B Building low-level waste, decontamination waste, tributyl phosphate waste, and laboratory waste from 241-B, -BX, and -C Tank Farms (DOE/RL 1991a). The *Tank Farm*

Surveillance and Waste Status Report for September 1991 (Hanlon 1992) shows that the tank contains 223,000 L (59,000 gal) of sludge.

The 241-B-103 Single-Shell Tank is included in the Watch List Tanks because of concentrations of organic salts and its waste contains >10 weight percent total organic carbon (TOC). The organic chemicals contained in this tank are potentially flammable, and when mixed with nitrate or nitrate salts can deflagrate. The temperature in tanks on this list are monitored weekly (Hanlon 1992).

2.3.2.1.4 241-B-104 Single-Shell Tank. The 241-B-104 Single-Shell Tank has undergone initial stabilization and interim isolation and is sound (Hanlon 1992).

This tank contains bismuth phosphate second-cycle waste; evaporator bottoms, bismuth phosphate first-cycle waste; supernatant containing evaporator bottoms from the 241-B Tank Farm (DOE/RL 1991a). An inadvertent discharge of sludge from this tank partially obstructed the 216-B-8TF Crib (Brown and Ruppert 1950).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 261,000 L (69,000 gal) of salt cake, 1,139,000 L (301,000 gal) of sludge, 174,000 L (46,000 gal) of drainable interstitial liquid, 95,000 L (25,000 gal) pumpable liquid, 178,000 L (47,000 gal) drainable liquid, and 4,000 L (1,000 gal) of supernatant.

2.3.2.1.5 241-B-105 Single-Shell Tank. The 241-B-105 Single-Shell Tank has undergone initial stabilization and interim isolation (Hanlon 1992). It is an assumed leaker.

This tank contains bismuth phosphate first- and second-cycle waste and flush water containing evaporator bottoms from the 241-B Tank Farm (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,007,000 L (266,000 gal) of salt cake, 151,000 L (40,000 gal) of sludge, and 87,000 L (23,000 gal) of drainable interstitial liquid.

2.3.2.1.6 241-B-106 Single-Shell Tank. The 241-B-106 Single-Shell Tank has undergone initial stabilization and interim isolation and is sound (Hanlon 1992).

This tank contains bismuth phosphate second-cycle waste; Hanford Laboratory operations waste; bismuth phosphate first-cycle waste; and supernatant containing tributyl phosphate waste; 224-U wastes, PNL waste, ion exchange waste, evaporator bottoms, 221-B Building low-level waste and bismuth phosphate first-cycle waste from 241-B, -BX, -BY and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 439,000 L (116,000 gal) of sludge, 27,000 L (7,000 gal) drainable liquid, 23,000 L (6,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

2.3.2.1.7 241-B-107 Single-Shell Tank. The 241-B-107 Single-Shell Tank has undergone initial stabilization and interim isolation and is an assumed leaker (Hanlon 1992).

This tank contains PUREX coating waste; bismuth phosphate first-cycle waste; and supernatant containing bismuth phosphate first- and second-cycle waste, and evaporator bottoms from the 241-B Tank Farms (DOE/RL 1991a). In January 1980 this tank was reclassified as a confirmed leaker (WHC 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 621,000 L (164,000 gal) of sludge, 49,000 L (13,000 gal) drainable liquid, 45,000 L (12,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

Soil surrounding the 241-B-107 Single-Shell Tank became contaminated when approximately 30,000 L (8,000 gal) of waste containing 2,000 Ci of ^{137}Cs leaked from the 241-B-107 Single-Shell Tank in 1968. This unplanned release is recorded as UPR-200-E-127.

2.3.2.1.8 241-B-108 Single-Shell Tank. The 241-B-108 Single-Shell Tank has undergone initial stabilization and interim isolation and is sound (Hanlon 1992).

This tank contains PUREX coating waste; bismuth phosphate first-cycle waste; and supernatant containing evaporator bottoms and ion exchange waste from the 241-B and -BY Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 356,000 L (94,000 gal) of sludge, 15,000 L (4,000 gal) drainable liquid, and 15,000 L (4,000 gal) of drainable interstitial liquid.

2.3.2.1.9 241-B-109 Single-Shell Tank. The 241-B-109 Single-Shell Tank has undergone initial stabilization and interim isolation and is sound (Hanlon 1992).

This tank contains PUREX coating waste; bismuth phosphate first-cycle waste; and supernatant containing evaporator bottoms and ion exchange waste, 224-U Building waste, and coating waste from the 241-B, -BY and -S Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 481,000 L (127,000 gal) of sludge, 30,000 L (8,000 gal) drainable liquid, 30,000 L (8,000 gal) of drainable interstitial liquid.

2.3.2.1.10 241-B-110 Single-Shell Tank. The 241-B-110 Single-Shell Tank has undergone initial stabilization and interim isolation and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate first- and second-cycle waste; fission product waste; 221-B Building high-level waste (waste fractionization); 221-B Building waste from Cells 5 and 6; 221-B Building flushes; and ion exchange waste (DOE/RL 1991a). This tank was reclassified as a confirmed leaker in June 1981 (WHC 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 927,000 L (245,000 gal) of sludge, 64,000 L (17,000 gal) of pumpable liquid, 87,000 L (23,000 gal) drainable liquid, 83,000 L (22,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

Unplanned release UPR-200-E-128 occurred in 1969 when approximately 31,400 L (8,300 gal) of waste containing about 4,300 Ci of ^{137}Cs leaked from the 241-B-110 Single-Shell Tank contaminating the soil surrounding the tank (WHC 1991a).

2.3.2.1.11 241-B-111 Single-Shell Tank. The 241-B-111 Single-Shell Tank has undergone initial stabilization and interim isolation and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate second-cycle waste; ion exchange waste (waste fractionization); fission product waste; 221-B Building waste from Cells 5 and 6 (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 893,000 L (236,000 gal) of sludge, 83,000 L (22,000 gal) drainable liquid, 80,000 L (21,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

2.3.2.1.12 241-B-112 Single-Shell Tank. The 241-B-112 Single-Shell Tank has undergone initial stabilization and interim isolation and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate second-cycle waste; 221-B Building waste from Cells 5 and 6; and supernatant containing 221-B Building waste from Cells 5 and 6, ion exchange waste, fission product waste, and evaporator bottoms from the 241-B and -BX Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 114,000 L (30,000 gal) of sludge, 11,000 L (3,000 gal) drainable liquid, 80,000 L (21,000 gal) of drainable interstitial liquid, and 11,000 L (3,000 gal) of supernatant.

2.3.2.1.13 241-B-201 Single-Shell Tank. The 241-B-201 Single-Shell Tank has been interim stabilized and interim isolated, and was reclassified as an assumed leaker in January 1980 (WHC 1991a). This tank contains 224-U Building waste (lanthanum fluoride) (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 106,000 L (28,000 gal) of sludge, 15,000 L (4,000 gal) drainable liquid, 11,000 L (3,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

In 1968 an unplanned release (UPR-200-E-129) occurred when about 4,500 L (1,200 gal) of waste containing approximately 420 Ci of ^{137}Cs leaked from tank 241-B-201 contaminating the soil surrounding and beneath the tank (WHC 1991a).

2.3.2.1.14 241-B-202 Single-Shell Tank. The 241-B-202 Single-Shell Tank has been interim stabilized and interim isolated, and is sound (Hanlon 1992). This tank contains 224-U Building waste (lanthanum fluoride) and 221-B Building high-level waste (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 102,000 L (27,000 gal) of sludge, 11,000 L (3,000 gal) drainable liquid, and 11,000 L (3,000 gal) of drainable interstitial liquid.

2.3.2.1.15 241-B-203 Single-Shell Tank. The 241-B-203 Single-Shell Tank has been interim stabilized and interim isolated, and is an assumed leaker (Hanlon 1992). This tank contains 224-U Building waste (lanthanum fluoride) (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 189,000 L (50,000 gal) of sludge, 23,000 L (6,000 gal) drainable liquid, 19,000 L (5,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

Unplanned release (UPR-200-E-130) occurred between 1951 to 1977 consisting of about 1,000 L (300 gal) of lanthanum fluoride that leaked from tank 241-B-203 and contaminated the soil surrounding and beneath the tank (WHC 1991a).

The 241-B-203 and 241-B-204 Single-Shell Tanks are listed as assumed leakers because of decreasing liquid levels. Operating Limit Deviation Report 82-08 was issued in May 1982 because of evidence of liquid level change, which exceeded the decrease criterion (WHC 1991a).

2.3.2.1.16 241-B-204 Single-Shell Tank. The 241-B-204 Single-Shell Tank has been interim stabilized and interim isolated, and is an assumed leaker (Hanlon 1992). This tank contains 224-U Building waste (lanthanum fluoride) and 221-B Building flushes (DOE/RL 1991a). The Environmental Deviation Report 83-02 was issued in November 1983 because of evidence of liquid level decrease, settling of the solids around the tank perimeter, liner corrosion, and intrusion (WHC 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 185,000 (49,000 gal) of sludge, 23,000 L (6,000 gal) drainable liquid, 19,000 L (5,000 gal) of drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

2.3.2.2 241-BX Tank Farm. Immediately west of the 241-B Tank Farm, on the west side of Baltimore Avenue is the 241-BX Tank Farm. This tank farm consists of a series of buried single-shell, carbon steel-lined, concrete reinforced tanks containing mixed waste. It is located about 800 m (2,600 ft) north of the 221-B Building adjacent to the southern boundary of the 241-BY Tank Farm and immediately west of the 241-BX Tank Farm and covers approximately 11,000 m^2 (120,000 ft^2). The surface elevation is about 200 m (655 ft) above msl with depth to groundwater between about 77 and 78 m (252 and 256 ft) below ground surface (Stalos and Walker 1977). The 241-BX Tank Farm contains 12 tanks of 2,017,000 L (533,000 gal) capacity, numbered 241-BX-101 through -112. The tanks began service between 1948 to 1950 and continued until the late 1970's. Figure 2-17 gives individual service dates. All tanks are 9 m (30 ft) high, with the bottom 11 m (37 ft) below grade. All tanks have a dished bottom and a 5 m (17 ft) operating height (DOE/RL 1991a). The tanks are inactive and have undergone initial stabilization and interim isolation (Hanlon 1992).

2.3.2.2.1 241-BX-101 Single-Shell Tank. The 241-BX-101 Single-Shell Tank is constructed of a carbon steel liner in a reinforced concrete shell. This tank is inactive, has undergone initial stabilization and interim isolation, and is an assumed leaker (Hanlon 1992). A P-10 salt well pump was installed in this tank to remove residual interstitial fluids when it was taken out of service.

This tank contains bismuth phosphate metal waste; evaporator bottoms; 221-B Building low-level mixed waste; ion exchange waste (waste fractionization); organic wash waste; REDOX ion exchange waste; and supernatant containing 221-B Building low-level waste, tributyl phosphate waste, inorganic wash waste, coating waste, and REDOX ion exchange waste from the 241-B, -BX , -BY, and -C Tank Farms. The unit received an inadvertent transfer of approximately 6,800 L (1,800 gal) of ARC-359 organic ion exchange resin in early 1972 (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 159,000 L (42,000 gal) of sludge, 4,000 L (1,000 gal) drainable liquid, and 4,000 L (1,000 gal) of supernatant.

2.3.2.2.2 241-BX-102 Single-Shell Tank. The 241-BX-102 Single-Shell Tank is inactive and has undergone initial stabilization and interim isolation (Hanlon 1992). It was classified as a confirmed leaker in 1971 and an attempt was made to stabilize the unit by addition of diatomaceous soil.

This tank contains bismuth phosphate metal waste; diatomaceous earth; and supernatant containing tributyl phosphate waste, metal waste, coating waste, 221-B Building low-level waste, and evaporator bottoms from the 241-B, -BX , -BY, and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 363,000 L (96,000 gal) of sludge, 15,000 L (4,000 gal) drainable liquid, and 15,000 L (4,000 gal) drainable interstitial liquid.

The tank is included in the Watch List Tanks, because it contains more than 1,000 g moles of ferrocyanide. These tanks have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. The tank is believed to contain between 1,000 and 3,000 g moles of ferrocyanide (Hanlon 1992).

A plugged cascade outlet allowed about 22.5 tons of soil to be contaminated by depleted uranium near the 241-BX-102 Single-Shell Tank. This incident occurred on March 20, 1951 and has been designated unplanned release UPR-200-E-5. No information regarding cleanup could be found (Stenner et al. 1988).

Unplanned release UPR-200-E-131 occurred at 241-BX-102 from 1948 until 1971 resulting from a leak that allowed about 51,000 Ci of ^{137}Cs contained in high-level, non-boiling liquid wastes to seep into the underlying soil. An estimated 31,000 ft^3 of soil has been affected extending to a depth of 37 m (120 ft). Some of the contaminants may have spread to groundwater during drilling of a monitoring well with a single string of 15 cm (6 in.) casing that went through the plume to the groundwater (Womack and Larkin 1971). The event occurred in July 1970 when Well 299E-33-27 was drilled to a depth of 80 m (255 ft).

In 1974 unplanned release UPR-200-E-132 occurred when 9,500 L (2,500 gal) of waste leaked from the 241-BX-102 Single-Shell Tank contaminating the ground around the unit. The area was excavated and after a radiation survey, backfilled with clean soil (Stenner et al. 1988).

2.3.2.2.3 241-BX-103 Single-Shell Tank. The 241-BX-103 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste and supernatant containing tributyl phosphate waste; metal waste; coating waste; organic wash waste; decontamination waste; ion exchange waste; PUREX low-level, high-level, and sludge supernatant wastes; PNL wastes, N Reactor waste; laboratory waste; evaporator bottoms; REDOX ion exchange waste; and 221-B Building low-level waste from the 241-B, -BX , -BY, and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 235,000 L (62,000 gal) of sludge, 15,000 L (4,000 gal) drainable liquid, and 15,000 L (4,000 gal) of supernatant liquid.

The 241-BX-103 Single-Shell Tank was documented as having contaminated soil in the vicinity of dry wells 21-03-03, -05, and -12 which is believed to be from tank overflow and spillage some years ago. It is estimated that 114,000 to 341,000 L (30,000 to 90,000 gal) of waste were spilled to the ground between tanks 241-BX-102 and -103 in 1951. It is uncertain why an unplanned release number was not assigned to this unit.

2.3.2.2.4 241-BX-104 Single-Shell Tank. The 241-BX-104 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; PUREX coating waste; ion exchange waste (waste fractionization); evaporator bottoms; and supernatant containing REDOX high-level waste, complexed and noncomplexed waste; double-shell slurry feed, tributyl phosphate waste, 221-B Building low-level waste, and ion exchange waste from the 241-B, -BX , -BY, and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 363,000 L (96,000 gal) of sludge, 102,000 L (27,000 gal) of pumpable liquid, 125,000 L (33,000 gal) of drainable liquid, 114,000 L (30,000 gal) drainable interstitial liquid, and 11,000 L (3,000 gal) of supernatant liquid. The September report also notes that 65,900 L (17,400 gal) of liquid have been pumped from this tank.

2.3.2.2.5 241-BX-105 Single-Shell Tank. The 241-BX-105 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste and supernatant containing metal waste; tributyl phosphate waste; coating waste; ion exchange waste; evaporator bottoms; complexed and noncomplexed waste; double-shell slurry feed from the 241-BX , -BY, -C, -S, and -SX Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 11,000 L (3,000 gal) of salt cake, 163,000 L (43,000 gal) of sludge, 15,000 L (4,000 gal) of pumpable liquid, 41,000 L (11,000 gal) of drainable liquid, 23,000 L (6,000 gal) drainable interstitial liquid, and 19,000 L (5,000 gal) of supernatant liquid. The report also notes that 57,000 L (15,000 gal) liquid have been pumped from this tank (Hanlon 1992).

2.3.2.2.6 241-BX-106 Single-Shell Tank. The 241-BX-106 Single-Shell Tank is inactive, has undergone partial isolation, and is sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste and supernatant containing metal waste; tributyl phosphate waste; coating waste; ion exchange waste; evaporator bottoms; 221-B Building low-level waste; organic wash waste; and REDOX ion exchange waste from the 241-B, -BX , and -BY Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 117,000 L (31,000 gal) of sludge, 57,000 L (15,000 gal) of pumpable liquid, 57,000 L (15,000 gal) of drainable liquid, 57,000 L (15,000 gal) of supernatant liquid.

The 241-BX-106 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 1,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BX-106 had a maximum temperature of 21 °C (69 °F) (Hanlon 1992).

2.3.2.2.7 241-BX-107 Single-Shell Tank. The 241-BX-107 Single-Shell Tank is inactive, has undergone initial stabilization and partial isolation, and is sound (Hanlon 1992). This tank contains bismuth phosphate first-cycle waste; tributyl phosphate waste; and supernatant containing ion exchange waste from the 241-BX Tank Farm (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,300,000 L (344,000 gal) of sludge, 87,000 L (23,000 gal) of pumpable liquid, 114,000 L (30,000 gal) of drainable liquid, 110,000 L (29,000 gal) drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant liquid. The report also notes that 874,000 L (23,100 gal) liquid have been pumped from this tank.

2.3.2.2.8 241-BX-108 Single-Shell Tank. The 241-BX-108 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate first-cycle waste, and supernatant containing tributyl phosphate waste, coating waste, and ion exchange waste the 241-BX and -C Tank Farms (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 98,000 L (26,000 gal) of sludge, 4,000 L (1,000 gal) of drainable liquid, and 4,000 L (1,000 gal) drainable interstitial liquid.

Unplanned release UPR-200-E-133 resulted when about 9,500 L (2,500 gal) of waste containing 500 Ci of ^{137}Cs leaked from the 241-BX-108 Single-Shell Tank. This incident occurred between 1949 and 1974 contaminating soil around and beneath the tank. Information concerning cleanup action was not available (WHC 1991a).

2.3.2.2.9 241-BX-109 Single-Shell Tank. The 241-BX-109 Single-Shell Tank is inactive, has undergone initial stabilization and partial isolation, and is sound (Hanlon 1992).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 731,000 L (193,000 gal) of sludge, 30,000 L (8,000 gal) of pumpable liquid, 49,000 L (13,000 gal) of drainable liquid, and 49,000 L (13,000 gal) drainable interstitial liquid. The report also notes that 31,000 L (8,200 gal) liquid have been pumped from this tank.

This tank contains bismuth phosphate first-cycle waste, tributyl phosphate waste, and ion exchange waste (waste fractionization) and supernatant containing tributyl phosphate waste from the 241-BY and -C Tank Farms (DOE/RL 1991a).

2.3.2.2.10 241-BX-110 Single-Shell Tank. The 241-BX-110 Single-Shell Tank is inactive, has undergone initial stabilization and partial isolation, and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate first-cycle waste; ion exchange waste (waste fractionization); evaporator bottoms; and supernatant containing coating waste, evaporator bottoms, and 221-B Building first-cycle waste from the 241-B and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 34,000 L (9,000 gal) of salt cake, 715,000 L (189,000 gal) of sludge, 79,000 L (21,000 gal) of drainable liquid, 76,000 L (20,000 gal) drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant.

The 241-BX-110 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 1,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BX-110 had a maximum temperature of 20 °C (68 °F) (Hanlon 1992).

2.3.2.2.11 241-BX-111 Single-Shell Tank. The 241-BX-111 Single-Shell Tank is inactive, has undergone partial isolation, and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate first-cycle waste; evaporator bottoms; in-tank solidification (ITS-2) bottoms and recycle system; and supernatant containing ion exchange waste, coating waste, and first-cycle waste from the 241-BX tanks (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 541,000 L (143,000 gal) of salt cake, 257,000 L (68,000 gal) of sludge, 178,000 L (47,000 gal) of pumpable liquid, 261,000 L (69,000 gal) of drainable liquid, 189,000 L (50,000 gal) drainable interstitial liquid, and 72,000 L (19,000 gal) of supernatant.

The 241-BX-111 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 1,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BX-111 had a maximum temperature of 23 °C (73 °F) (Hanlon 1992).

2.3.2.2.12 241-BX-112 Single-Shell Tank. The 241-BX-112 Single-Shell Tank is inactive, has undergone initial stabilization, and partial interim isolation and is sound (Hanlon 1992).

This tank contains ion exchange waste (waste fractionization); supernatant containing evaporator bottoms waste; coating waste, and first-cycle waste from the 241-C tanks (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 621,000 L (164,000 gal) of sludge, 8,000 L (2,000 gal) of pumpable liquid, 30,000 L (8,000 gal) of drainable liquid, 26,000 L (7,000 gal) drainable interstitial liquid, and 4,000 L (1,000 gal) of supernatant. The report also notes that 16,000 L (4,100 gal) have been pumped from this tank (Hanlon 1992).

2.3.2.3 241-BY Tank Farm. The 241-BY Tank Farm is located about 900 m (3,000 ft) north of the 221-B Building and is adjacent to the northern boundary of the 241-BX Tank Farm and covers approximately 11,000 m^2 (120,000 ft^2). The surface elevation is about 198 m (648 ft) above msl with groundwater about 75 m (246 ft) below ground surface (Stalos and Walker 1977). There are twelve 2,870,000 L (758,000 gal) tanks in the farm numbered 241-BY-101 through -112. They were put into service between 1950 and 1953 and continued until the late 1970's. Figure 2-17 gives individual tank service dates. All the tanks are constructed of a carbon steel liner in a reinforced concrete shell, 11 m (37 ft) high, with the bottom 14 m (45 ft) below grade. The tank has a dished bottom and a 7 m (23 ft) operating height (DOE/RL 1991a).

2.3.2.3.1 241-BY-101 Single-Shell Tank. The 241-BY-101 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste and supernatant containing tributyl phosphate waste and evaporator bottoms from the 241-BY and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,052,000 L (278,000 gal) of salt cake, 413,000 L (109,000 gal) of sludge, 19,000 L (5,000 gal) of drainable liquid, and 19,000 L (5,000 gal) drainable interstitial liquid. The report also notes that 136,000 L (35,800 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-101 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 1,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-101 had a maximum temperature of 23 °C (74 °F) (Hanlon 1992).

2.3.2.3.2 241-BY-102 Single-Shell Tank. The 241-BY-102 Single-Shell Tank is inactive, has undergone partial isolation, and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; and supernatant containing tributyl phosphate waste, coating waste, and evaporator bottoms from the 241-BX, -BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,291,000 L (341,000 gal) of salt cake, no sludge, 79,400 L (21,000 gal) of pumpable liquid, 162,500 L (43,000 gal) of drainable liquid, and 162,500 L (43,000 gal) drainable interstitial liquid. The report also notes that 549,200 L (145,300 gal) have been pumped from this tank (Hanlon 1992).

2.3.2.3.3 241-BY-103 Single-Shell Tank. The 241-BY-103 Single-Shell Tank is inactive, has undergone partial isolation, and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate metal waste; PUREX coating waste; and supernatant containing coating waste, tributyl phosphate waste, and PUREX high-level and organic wash wastes from the 241-BX, -BY and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,495,000 L (395,000 gal) of salt cake, 19,000 L (5,000 gal) of sludge, 326,000 L (86,000 gal) of pumpable liquid, 409,000 L (108,000 gal) of drainable liquid, and 409,000 L (108,000 gal) drainable interstitial liquid. The report also notes that 297,000 L (78,500 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-103 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 1,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-103 had a maximum temperature of 27 °C (81 °F) (Hanlon 1992).

2.3.2.3.4 241-BY-104 Single-Shell Tank. The 241-BY-104 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; tributyl phosphate waste; and supernatant containing coating waste, tributyl phosphate waste, ion exchange waste, and evaporator bottoms from the 241-BX, -BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,385,000 L (366,000 gal) of salt cake, 151,000 L (40,000 gal) of sludge, 68,000 L (18,000 gal) of drainable liquid, and 68,000 L (18,000 gal) drainable interstitial liquid. The report also notes that 1,247,000 L (329,500 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-104 Single-Shell Tank is included in the Watch List Tanks, because it contains between 100,000 and 200,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-104 had a maximum temperature of 54 °C (130 °F) (Hanlon 1992).

2.3.2.3.5 241-BY-105 Single-Shell Tank. The 241-BY-105 Single-Shell Tank is inactive, has undergone partial isolation, and is an assumed leaker (Hanlon 1992).

This tank contains tributyl phosphate waste; bismuth phosphate metal waste; and supernatant containing tributyl phosphate waste, coating waste, and evaporator bottoms from the 241-BX, -BY, and -C Tank Farms.

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,737,000 L (459,000 gal) of salt cake, 167,000 L (44,000 gal) of sludge, 651,000 L (172,000 gal) of pumpable liquid, 734,000 L (194,000 gal) of drainable liquid, and 734,000 L (194,000 gal) drainable interstitial liquid.

The 241-BY-105 Single-Shell Tank is included in the Watch List Tanks, because it contains between 70,000 and 100,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-105 had a maximum temperature of 46 °C (114 °F) (Hanlon 1992).

In November 1966, 63 tons of Portland cement were added to tank 241-BY-105 (assumed leaker) to determine the immobilization properties of the cement. The tank was then connected to an exhaust system for temperature control. A maximum temperature of 63 °C (146 °F) was recorded 10 cm (4 in.) above the bottom liner (Hanlon 1992).

2.3.2.3.6 241-BY-106 Single-Shell Tank. The 241-BY-106 Single-Shell Tank is inactive, has undergone partial isolation, and is an assumed leaker (Hanlon 1992).

This tank contains first cycle waste; tributyl phosphate waste; and supernatant containing coating waste, tributyl phosphate waste, bismuth phosphate first cycle waste; and evaporator bottoms from the 241-BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 2,070,000 L (547,000 gal) of salt cake, 360,000 L (95,000 gal) of sludge, 806,000 L (213,000 gal) of pumpable liquid, 889,000 L (235,000 gal) of drainable liquid, 889,000 L (235,000 gal) drainable interstitial liquid.

The 241-BY-106 Single-Shell Tank is included in the Watch List Tanks, because it contains approximately 30,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-106 had a maximum temperature of 55 °C (131 °F) (Hanlon 1992).

2.3.2.3.7 241-BY-107 Single-Shell Tank. The 241-BY-107 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is an assumed leaker (Hanlon 1992).

This tank contains tributyl phosphate waste; bismuth phosphate first cycle waste; and supernatant containing tributyl phosphate waste, coating waste, and evaporator bottoms from the 241-BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 780,000 L (206,000 gal) of salt cake, 227,000 L (60,000 gal) of sludge, 95,000 L (25,000 gal) of drainable liquid, and 95,000 L (25,000 gal) drainable interstitial liquid. The report also notes that 1,247,000 L (329,500 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-107 Single-Shell Tank is included in the Watch List Tanks, because it contains between 30,000 and 80,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-107 had a maximum temperature of 28 °C (83 °F) (Hanlon 1992).

2.3.2.3.8 241-BY-108 Single-Shell Tank. The 241-BY-108 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is an assumed leaker (Hanlon 1992).

This tank contains bismuth phosphate first-cycle waste; tributyl phosphate waste; and supernatant containing tributyl phosphate waste, and evaporator bottoms from the 241-BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 280,000 L (74,000 gal) of salt cake, 583,000 L (154,000 gal) of sludge, 34,000 L (9,000 gal) of drainable liquid, and 34,000 L (9,000 gal) drainable interstitial liquid. The report also notes that 104,000 L (27,500 gal) have been pumped from this tank (Hanlon 1992).

Between 1955 and 1972 approximately 19,000 L (5,000 gal) of tributyl phosphate waste leaked from the tank contaminating the soil surrounding and underneath the tank. This leak was documented as unplanned release UPR-200-E-135.

The 241-BY-108 Single-Shell Tank is included in the Watch List Tanks, because it contains between 30,000 and 70,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-108 had a maximum temperature of 38 °C (101 °F) (Hanlon 1992).

2.3.2.3.9 241-BY-109 Single-Shell Tank. The 241-BY-109 Single-Shell Tank is inactive, has undergone partial isolation, and is sound (Hanlon 1992).

This tank contains supernatant containing tributyl phosphate waste, PUREX coating waste; bismuth phosphate metal wastes; evaporator bottoms; and PUREX organic wash waste from the 241-B, -BX, -BY, and -C Tank Farms. This is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,287,000 L (340,000 gal) of salt cake, 314,000 L (83,000 gal) of sludge, 158,800 L (42,000 gal) of pumpable liquid, 264,600 L (70,000 gal) of drainable liquid, and 264,600 L (70,000 gal) drainable interstitial liquid. The report also notes that 416,200 L (110,100 gal) have been pumped from this tank (Hanlon 1992).

2.3.2.3.10 241-BY-110 Single-Shell Tank. The 241-BY-110 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is sound (Hanlon 1992).

This tank contains bismuth phosphate first-cycle waste; tributyl phosphate waste; and supernatant containing evaporator bottoms, tributyl phosphate waste, and coating waste from the 241-BY, and -C Tank Farms and the WR-241 Tank (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,117,000 L (295,000 gal) of salt cake, 390,000 L (103,000 gal) of sludge, 34,000 L (9,000 gal) of drainable liquid, and 34,000 L (9,000 gal) drainable interstitial liquid. The report also notes that 807,300 L (213,300 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-110 Single-Shell Tank is included in the Watch List Tanks, because it contains between 50,000 and 90,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-110 had a maximum temperature of 51 °C (124 °F) (Hanlon 1992).

2.3.2.3.11 241-BY-111 Single-Shell Tank. The 241-BY-111 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; tributyl phosphate; PUREX coating waste; organic wash waste; and supernatant containing evaporator bottoms, tributyl phosphate waste, coating waste and organic wash waste from the 241-BY, and -C Tank Farms. It is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,658,000 L (438,000 gal) of salt cake, and 79,000 L (21,000 gal) of sludge. The report also notes that 1,185,000 L (313,200 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-111 Single-Shell Tank is included in the Watch List Tanks, because it contains up to 3,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September, 1991, tank 241-BY-111 had a maximum temperature of 33 °C (92 °F) (Hanlon 1992).

2.3.2.3.12 241-BY-112 Single-Shell Tank. The 241-BY-112 Single-Shell Tank is inactive, has undergone initial stabilization and interim isolation, and is considered sound (Hanlon 1992).

This tank contains bismuth phosphate metal waste; tributyl phosphate; and supernatant containing tributyl phosphate waste, coating waste and evaporator bottoms from the 241-B, -BX, -BY, and -C Tank Farms. It is an ITS-2 unit (DOE/RL 1991a).

The *Tank Farm Surveillance and Waste Status Report for September 1991* (Hanlon 1992) shows that the tank contains 1,083,000 L (286,000 gal) of salt cake, 19,000 L (5,000 gal) of sludge, 30,000 L (8,000 gal) of drainable liquid, and 30,000 (8,000 gal) drainable interstitial liquid. The report also notes that 441,000 L (116,400 gal) have been pumped from this tank (Hanlon 1992).

The 241-BY-112 Single-Shell Tank is included in the Watch List Tanks, because it contains between 2,000 and 3,000 g moles of ferrocyanide. Tanks containing more than 1,000 g moles of ferrocyanide have been declared an Unreviewed Safety Question because their explosion potential exceeds previously reported safety analysis consequences. These tanks are monitored weekly; in September 1991, tank 241-BY-112 had a maximum temperature of 29 °C (85 °F) (Hanlon 1992).

Unplanned release UPR-200-E-116 occurred on November 20, 1972 when an unknown volume of caustic flush water containing ^{137}Cs, ^{90}Y, ^{89}Sr, and ^{90}Sr sprayed from the 241-BY-112 pump associated with the 241-BY-112 Single-Shell Tank. Radiation levels up to 3 R/h were measured 15 cm (6 in.) above the waste.

2.3.2.4 241-B-301B Catch Tank. The 241-B-301B Catch Tank is located approximately 9 m (30 ft) south of the 241-B-252 Diversion Box. The tank collects waste spilled in the 241-B-151, 241-B-152, 241-B-153, and 241-B-252 Diversion Boxes during transfers. It was in service from 1945 until 1984. Its contents are unknown and it was isolated in 1985 (Hanlon 1992).

2.3.2.5 241-B-302B Catch Tank/UPR-200-E-77. The 241-B-302B Catch Tank is located on the northeast corner of Baltimore Avenue and 7th Street. It is located approximately 12 m (40 ft) north of the 241-B-154 Diversion Box. The tank collects waste spilled in the diversion box during transfers. It was in service from 1945 until 1985. In 1985 the diversion box was isolated and stabilized by application of a weather-proofing plasticizer (WHC 1991a).

Unplanned release UPR-200-E-77 was caused by metal waste solution from the 221-B Building with fission products measuring approximately 1 Ci contaminating the ground around the 241-B-154 Diversion Box (and consequently the 241-B-302B Catch Tank) in 1946 during work associated with the repair of a leaky jumper in the box. The unplanned release site was covered with 0.3 m (1 ft) of soil after the incident. It is probable that cover blocks were open during the repairs; therefore, the contamination may be mainly surface.

2.3.2.6 241-BX-302A Catch Tank. The 241-BX-302A Catch Tank is associated with the 241-BR-152, 241-BX-153, 241-BXR-152, and 241-BYR-152 Diversion Boxes and the 241-BX Tank Farm. It is located approximately 9 m (30 ft) east of the 241-BX-153 Diversion Box and collects waste spilled during transfers between these diversion boxes and the 241-BX Tank Farm. The catch tank was in service from 1948 until its isolation in July 1985. The tank is associated with the 241-BX Tank Farm where leak detection and air monitoring are performed continuously.

2.3.2.7 241-BX-302B Catch Tank. The 241-BX-302B Catch Tank is located adjacent to and below the 241-BX-154 Diversion Box. The tank collects waste spilled in the diversion box during transfers (Hanlon 1992). It was in service from 1948 until 1985. The catch tank has been isolated and stabilized by application of a weather proofing plasticizer (Hanlon 1992).

2.3.2.8 241-BX-302C Catch Tank/UPR-200-E-78. The 241-BX-302C Catch Tank is located approximately 9 m (30 ft) east of the 241-BX-155 Diversion Box. The tank collects waste spilled in the diversion box during transfers. It was in service from 1948 until 1985. This inactive waste management unit is located about 260 m (850 ft) northeast of the 221-B Building between Atlanta and Baltimore Avenues.

Unplanned release UPR-200-E-78 occurred when salt waste containing about 10 Ci of mixed fission products leaked from the 241-BX-151 Diversion Box during pressure testing of lines and jumpers, contaminating about 20 m^2 (200 ft^2) of the surrounding soil. The area was then covered with clean soil. Because the pressure test may have been conducted when the cover blocks were off (to allow observation), the contamination may be mainly surface.

2.3.2.9 241-ER-311 Catch Tank/UPR-200-E-84. The 241-ER-311 Catch Tank is located 300 m (900 ft) southwest of the 221-B Building and is not associated with a tank farm. The catch tank is located adjacent to and at a lower elevation than the 241-ER-151 Diversion Box. The catch tank receives cross-site process and decontamination waste from the 241-UX-154 Diversion Box via the 241-EW-151 Vent Station. Waste is also received from the 241-B, -BX, and -BY Tank Farms via the 244-BX DCRT (WHC 1991a). The catch tank collects waste spilled in the diversion box during transfers (WHC 1991a). The catch tank and diversion box are located approximately 55 m (180 ft) southeast of the 224-B Concentration Facility. The tank is located approximately 7 m (22 ft) south of the 241-ER-

151 Diversion Box. The waste management unit was activated in 1945 and transfers various types of waste solutions from processing and decontamination operations (WHC 1991a).

Unplanned release UPR-200-E-84 occurred in March 1953 when the catch tank leaked about 6,500 L (1,700 gal) of acid contaminated with approximately 10 Ci of fission products to the ground (Stenner et al. 1988). At the time of release, no ground surface contamination was detected. This is a low activity unplanned release site. Historical records do not indicate whether the tank was repaired or if the tank "leak" was caused by overfilling. There is no mention of any cleanup of the site.

2.3.2.10 241-B-361 Settling Tank. This inactive waste management unit is located 183 m (600 ft) northeast of the 221-B Building on the east side of Baltimore Avenue. The settling tank was in operation from April 1945 to September 1947 receiving low salt alkaline radioactive waste from cell washings collected in the 5-6W Cell in the 221-B Building and additional waste from the 224-B Concentration Facility. Overflow from this tank was injected to the 216-B-5 Reverse Well. An estimated 121,000 L (32,000 gal) of sludge, consisting primarily of bismuth phosphate, with about 2.46 kg (1.12 lb) of plutonium is contained in the tank (DOE/RL 1991a).

Although this waste management unit was interim stabilized in 1985, the release potential for radiological hazard rates are high in comparison to other 200 Area waste management units (DOE/RL 1991a).

2.3.2.11 270-E Condensate Neutralization Tank. The 270-E Condensate Neutralization Tank is located west of the 221-B Building. The unit is approximately 3 m (9 ft) in diameter and height, with the bottom at approximately 4 m (12 ft) below grade. A 8-cm (3-in.) stainless pipe enters at the bottom, and a 15-cm (6-in.) vitreous clay pipe exits near the top.

Unplanned release UN-200-E-64 resulted from ants burrowing into and distributing soil that was possibly contaminated by leakage from this tank. The coordinates in WIDS give a location approximately 31 m (100 ft) east of the tank. This unplanned release is described more fully in Section 2.3.8.3.

The 270-E Condensate Neutralization Tank was used from 1952 until 1970. Very little information is known about the use and function of this tank. Old drawings show that this tank was constructed as part of a neutralization facility in 1952. A 8-cm (3-in.) schedule 40 stainless steel line from the 221-B Building entered at the bottom of the tank. A 15-cm (6-in.) vitreous clay pipe exited from top of the tank and went to the 216-B-12 Crib. This arrangement suggests that one of the functions of the tank was to remove solids from the fluid passing through the tank so that only a decanted supernatant liquid flowed to the crib. The tank contained a 102-cm (40-in.) diameter riser that extended from the top of the tank below grade up to a wooden platform constructed above the tank. The relatively large size of this riser suggests that access to the tank contents was required, probably to add neutralization agents to the tank contents. A 270-E wooden building was constructed next to the wooden platform above the tank, which may have been used to store neutralization solids. The neutralization material used was probably limestone as one reference lists the 216-B-12 Crib as a "limestone-neutralized" crib during the time period that the tank was operational (Tabasinske 1958). The tank was operational during the time period when the 221-B Building was being decommissioned and placed in "layaway" status. It appears possible that this tank may have been used to neutralize condensate produced by the evaporation of waste produced during acid cleaning of process equipment during decommissioning activities at the 221-B Building. The present status of the tank is unknown. Drawings show that the neutralization building was removed and the tank was capped and abandoned in place by 1970. The tank was apparently not used when the 216-B-12 Crib became operational again in 1967 in support of the cesium and strontium recovery mission for B Plant. The tank is thought to contain about 14,000 L (3,800 gal) of sludge. The prioritization of this facility for decommissioning classifies the relative radiological hazard as high in comparison with other 200 Area surplus facilities (DOE/RL 1991a).

2.3.2.12 244-BXR Receiving Vault. The 244-BXR Receiving Vault is an inactive waste management unit located at the southern boundary in the 241-B Tank Farm. The unit was in operation from 1948 until July 1985 transferring waste solutions from processing and decontamination operations. The unit has been isolated and weather covered. The WIDS radionuclide inventories were not available for this waste management unit. Leak detection and air monitoring are performed continuously within the 241-B Tank Farm in which the unit is located (DOE/RL 1991a).

2.3.3 Cribs and Drains

Cribs and tile fields and drains were all designed to percolate wastewaster into the ground without exposing it to the open air. Various types of cribs were built in the B Plant Aggregate Area: 4 x 4 m (12 x 12 ft) open-bottom wooden boxes; vertical concrete pipes, either alone or parallel to nearby pipes; horizontal perforated pipes; dispersion structures made of cinder blocks resting on wood. Tile fields are semihorizontal perforated pipes set out in a chevron pattern. Where wooden cribs and tile fields are associated, the main feed pipe of the tile field exits the crib near the top, on the side opposite of the crib inlet pipe. Figures 2-21 through 2-24 show several types of cribs. Drains are vertical, shallow, gravel-filled concrete pipes.

The cribs and drains received low-level waste for disposal. Most cribs, drains, and trenches were designed to receive liquid until the unit's specific retention or radionuclide capacity was met. The term "specific retention" is defined as that volume of waste liquid that may be disposed to the soil and be held against the force of gravity by the molecular attraction between sand grains and the surface tension of the water, when expressed as a percent of the packed soil volume (Bierschenk 1959). Radionuclide capacity refers to a specific number of curies of radioactivity the waste management units were allowed to receive until they were shut down (Fecht et al. 1977). The locations of all cribs, drains, and reverse wells are shown on Figure 2-4. The following sections describes each crib and drain in the B Plant Aggregate Area.

2.3.3.1 216-B-7A and 216-B-7B Cribs. The 216-B-7A and 216-B-7B Cribs (also known as 241-B-1 and 241-B-2 Cribs) are inactive waste management units located about 30 m (100 ft) north of 241-B Tank Farm. The two cribs are located approximately 6 m (20 ft) apart and are in line with a 8 cm (3 in.) steel inlet pipe that supplied waste to both cribs simultaneously. Each crib is a 4 x 4 x 1.2 m (12 x 12 x 4 ft) wooden structure made of 15 x 15 cm (6 x 6 in.) timbers, placed in a 4.2 x 4.2 x 4.2 m (14 x 14 x 14 ft) deep excavation. During their operational lifetime the cribs received a total volume of 43,600,000 L (11,500,000 gal) of wastewater. Each crib is a hollow structure, i.e., not gravel filled. Both units are classified as having cave-in potential.

From October 1946 to August 1948 these cribs received overflow from the 201-B Settling Tank. The 201-B Settling Tank was taken out of service in October 1948, because it was nearly filled with sludge from the 221-B Building and 224-B Concentration Facility wastes. The 202-B through 204-B Settling Tanks were connected in series, and began flowing into the crib in December 1948 (Brown and Ruppert 1950). The 224-B Concentration Facility was the source of the waste sent to the settling tank. Between October 1947 and August 1948 the cribs also received cell drainage and other liquid wastes from Tank 5-6 in the 221-B Building. After August 1948 liquid waste from the 224-B Concentration Facility was disposed of directly to the cribs until October 1961. From December 1954 to October 1961 the 224-B Concentration Facility waste consisted of clean-out waste. Between October 1961 and May 1, 1967 material disposed of in these cribs consisted of decontamination construction waste from the 221-B Building. The cribs became inactive in 1967.

Some inorganic liquids were also disposed of at this waste management unit. Radionuclides contained within the waste stream include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, uranium, and TRU fission products (Brown et al. 1990). The 22,300,000 L (5,890,000 gal) of waste jetted to the 201-B through 204-B Settling Tanks between 1947 and 1950 contained 2,180 g of plutonium and 4,000 Ci of fission products (Brown and Ruppert 1950). By deducting the volume of the four settling tanks it is estimated that 96% of this volume, 21,470,000 L (5,670,000 gal), ultimately reached the 216-B-7A and 216-B-7B Cribs. An additional 22,100,000 L (5,800,000 gal) of wastewater was discharged to the cribs after 1950 until they were taken out of service in 1967.

2.3.3.2 216-B-8TF Crib and Tile Field. The 216-B-8TF Crib and Tile Field is an inactive waste management unit located about 107 m (350 ft) north of 241-B Tank Farm. The crib is a 4 x 4 m (12 x 12 ft) wooden structure in a 4.2 x 4.2 x 6.9 m (14 x 14 x 22.5 ft) deep excavation. The hollow structure is not gravel filled and has cave-in potential. The tile field is 91 m (300 ft) long, 30 m (100 ft) wide, and fed by a 30 cm (12 in.) VCP trunk with eight, 21 m (70 ft) pipes branching at 45 degrees (DOE/RL 1991a). The unit was connected to the 241-B-110, -111, and -112 Single-Shell Tanks of the 241-B Tank Farm and received about 27,200,000 L (7,190,000 gal) of waste between April 1948 and July 1953. Waste types included second-cycle waste supernatant from the 221-B Building until July 1951, cell drainage and other liquid waste from Tank 5-6 in the 221-B Building in addition to second-cycle supernatant from July 1951 until December 1951, and decontamination and cleanup waste generated during the shutdown of the 224-B Concentration Facility from December 1951 to December 1952 (Stenner et al. 1988; Brown et al. 1990).

According to Brown and Ruppert (1950), a total of 18,400,000 L (4,861,295 gal) of wastes containing approximately 95 g of plutonium and 2,050 Ci of fission products was discharged to the crib between August 1948 and January 1950. The 216-B-8TF Crib system was tied directly to the waste lines, bypassing the 241-B-361 Settling Tank, and sludge accumulated in the crib, decreasing its capacity. Citric and hydrochloric acid were added to the crib to keep it in operation.

Some of the sludge recovered in sample cups in an adjacent shaft 6 m (20 ft) below ground surface showed plutonium activity was 990 μg/kg (approximately 1,000 times higher than in the supernatant). The fission product activity in the sludge was roughly 5,000 times higher than in the supernatant (Brown and Ruppert 1950). Highly permeable sediments conducted radioactive contaminants that leached from the sludge downward and laterally beneath the crib. However, very little plutonium penetrated greater than 3 m (10 ft) below the crib, except where transported by sludge (Brown and Ruppert 1950).

2.3.3.3 216-B-9TF Crib and Tile Field. The 216-B-9TF Crib and Tile Field is an inactive waste management unit located along Baltimore Avenue approximately 380 m (1,250 ft) south of the 241-B Tank Farm. It consists of a wooden box, 4.2 x 4.2 x 2.4 m (14 x 14 x 8 ft) with a tile field to the north. The hollow structure is not gravel filled and has cave-in potential. The tile field is 55 x 26 m (180 x 84 ft) consists of a 15 cm (6 in.) clay tile pipe main set at 1% slope with six laterals at 45 degrees (DOE/RL 1991a). The tile pipes have 46 cm (18 in.) of gravel above and below, and are covered with roofing felt. The trenches for the pipe are 1.2 m (4 ft) wide at the bottom and the side slopes are 1:1.5. The tile pipes are 4 m (12 ft) below grade at the head and 2 m (6 ft) at the end (DOE/RL 1991a).

Between August 1948 and July 1951 the unit received about 36,000,000 L (9,500,000 gal) of cell drainage and Tank 5-6 liquid wastes from the 221-B Building. In August 1948 the 216-B-9TF Crib and Tile Field were connected to the waste line from the 221-B Building when the 216-B-5 Reverse Well was deactivated. The 241-B-361 Settling Tank was bypassed, since it was nearly filled with sludge from the operations with the 216-B-5 Reverse Well (Brown and Ruppert 1950). Consequently, suspended solids with significantly higher radionuclide concentrations settled out as sludge in the wooden crib, significantly decreasing its volume. Overflow into the tile field began in November 1948, after about 4,000,000 L (1,000,000 gal) had flowed into the crib and filled it with sludge. Acid was added to dissolve the sludge earlier to extend the life of the crib (Brown and Ruppert 1950).

The WIDS Hazardous Chemical Inventory lists only 1,000 kg (2,000 lb) of nitrate contained within the waste stream. Radionuclides include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, uranium, and TRU elements. The waste management unit was deactivated by disconnecting the supply line from the 241-B-154 Diversion Box when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979; Brown et al. 1990).

2.3.3.4 216-B-10A and 216-B-10B Cribs. The 216-B-10A and 216-B-10B Cribs are located about 50 m (160 ft) south of the west end of the 222-B Building and are inactive. The waste management units consist of a roughly 4 x 4 x 1.1 m (12 x 12 x 3.5 ft) wooden box, in an excavation with 4.2 x 4.2 m (14 x 14 ft) bottom area and 1:1 side slopes (DOE/RL 1991a). The bottom of the excavation is 6 m (20 ft) below grade. The structure is not gravel filled and has cave-in potential.

The 216-B-10A Crib was used from December 1949 to January 1952 and received decontamination sink and sample slurper waste from the 222-B Building and floor drainage from the 292-B Building (Stenner et al. 1988; WHC 1991a). During this time the crib received acidic liquid waste that contained TRU and fission products. Nitric acid and sodium dichromate were some of the inorganics also disposed of at the cribs. Radionuclides contained in the waste stream include ^{137}Cs, ^{106}Ru, ^{90}Sr, and plutonium (Stenner et al. 1988; Brown et al. 1990).

The 216-B-10B Crib received cascaded waste from the 216-B-10A Crib when it was in service. Decontamination sink and shower waste from the 221-B Building was sent directly to the 216-B-10B Crib from June 1969 through October 1973. Similar inorganic and radionuclide wastes were disposed of in both cribs; however, the volume in the 216-B-10B Crib was approximately 1/30 that of the 216-B-10A Crib.

Both cribs were deactivated by disconnecting the pipeline to the units. The earth has subsided about 1 m (3 ft) over the top of both of the units indicating deterioration of the structures (WHC 1991a).

2.3.3.5 216-B-12 Crib. The 216-B-12 Crib is located 300 m (1,000 ft) northwest of 221-B Building. The crib operated from November 1952 through December 1957 and from May 1967 through November 1973 and is now inactive. The unit consists of a series of three cascading, 5 x 5 x 3 m (16 x 16 x 10 ft) high wooden boxes in a 9 m (30 ft) deep excavation. The bottom 4 m (12 ft) contains 1.3 cm (0.5 in.) gravel backfill, 1.2 m (4 ft) of which underlie the cribs. The excavation has side slopes of 1:1 (DOE/RL 1991b). The bottom dimensions are 49 x 15 m (160 x 50 ft) (Maxfield 1979). It is unclear if the gravel backfill merely surrounds the boxes or also fills them; however, the unit is considered to have cave-in potential.

The crib was inactive between December 1957 through May 1967. Radiation Occurrence Report 73-82 suggests the 216-B-12 Crib was abandoned on November 1973 when the ground above the crib started to subside resulting in flow restrictions. It was backfilled in 1973 and the fill line was capped in March 1974 (Maxfield 1979). Cave-in potential is still of concern.

During its service history, the crib received process condensate from the waste evaporators in the 221-U Building and 224-U Concentration Facility until December 1957; construction waste from the 221-B Building from May 1967 to November 1967; and process condensate from the 221-B Building after November 1967. The waste is low salt and neutral/basic. Inorganics disposed of at this crib include ammonium nitrate (Stenner et al. 1988). Radionuclides present in the monitoring wells associated with the structure include ^{137}Cs, ^{106}Ru, ^{90}Sr, ^{3}H, ^{60}Co, and ^{239}Pu (Brown et al. 1990). The crib has a collapse potential because of its wooden construction.

2.3.3.6 216-B-14 Crib. Cribs 216-B-14 through -19 are located in the BC Controlled Area, south of the 200-E Area. Cross sections of these cribs are shown on Figure 2-22. The 216-B-14 Crib is an inactive waste management unit located in the BC Crib area west of Baltimore Avenue on 1st Street. An unmarked gravel road leads to the BC Crib-Trench units, which lay outside of the 200 East security area. The crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel. It is built over a 1.5 m (5 ft) thick gravel bed and was fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Figure 2-22) (Maxfield 1979; Stenner et al. 1988). The wood base of the crib is considered a collapse hazard (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

The 216-B-14 Crib received 8,710,000 L (2,301,000 gal) of scavenged tributyl phosphate waste from the 221-U Building from January to February 1956. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a;

Fecht et al. 1977; Brown et al. 1990). The crib was deactivated by disconnecting the pipeline to the unit when the calculated specific retention of the underlying soil column was achieved (Lundgren 1970).

Stabilization of the entire crib was completed in August 1981. Prior to stabilization the vent filter boxes, 20 cm (8 in.) vent risers, liquid level risers, 5 cm (2 in.) vent risers, and valve handle extensions were removed at or below existing grade and disposed of in the 218-E-12B Burial Ground. As the vent filters and risers were removed, expanding rubber plugs were installed in each opening. The eight vadose monitoring well casings were extended to accommodate the addition of clean soil cover. One m (2.5 ft) of topsoil treated with the herbicides and 2,4-D amine plus a polymer, and a rodent deterrent consisting of sucrose octa-acetate were added as cover material then seeded with wintergraze, thickspike, crested, and Siberian wheatgrasses.

About 30 m (100 ft) south of the BC Cribs is a 9 x 30 m (30 x 100 ft) area delineated with metal posts and underground contamination signs. This area is devoid of any vegetation. It is not reflected on any of the drawings and is reported to be a radionuclide migration study area. Evidence of wildlife (rabbit droppings, paw and hoof prints) is seen throughout the BC Cribs.

2.3.3.7 216-B-15 Crib. The 216-B-15 Crib is located northwest of the 216-B-14 Crib. It is inactive. This crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel, placed over a 1.5 m (5 ft) thick gravel bed and was fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Maxfield 1979; Stenner et al. 1988). The wood base of the crib is considered a collapse hazard (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

This crib received 6,320,000 L (1,670,00 gal) of scavenged tributyl phosphate waste from the 221-U Building from April 1956 until December 1957. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Fecht et al. 1977; Brown et al. 1990). The crib was deactivated by blanking the feed pipe to the unit when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979).

2.3.3.8 216-B-16 Crib. The 216-B-16 Crib is inactive and located southwest of the 216-B-14 Crib. This crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel, placed over a 1.5 m (5 ft) thick gravel bed and is fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Maxfield 1979; Stenner et. al. 1988). The wood base of the crib is considered a collapse hazard (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

This crib received 5,600,000 L (1,500,000 gal) of scavenged tributyl phosphate waste from the 221-U Building between April and August 1956. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Fecht et al. 1977; Brown et al. 1990). The crib was deactivated by valving out the feed pipe to the crib when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979).

2.3.3.9 216-B-17 Crib. The 216-B-17 Crib is located northwest of the 216-B-16 Crib. It is inactive. This crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel, placed over a 1.5 m (5 ft) thick gravel bed and fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Maxfield 1979; Stenner et al. 1988). Because the base of the crib is wood there is a small potential for collapse (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

In January 1956 this crib received 3,410,000 L (901,000 gal) of scavenged tributyl phosphate waste from the 221-U Building. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Fecht et al. 1977; Brown et al. 1990). The crib was deactivated by valving out the feed pipe to the to the crib when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979).

2.3.3.10 216-B-18 Crib. The 216-B-18 Crib is an inactive waste management unit located southwest of the 216-B-16 Crib. This crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel, placed over a 1.5 m (5 ft) thick gravel bed and are fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Maxfield 1979; Stenner et al. 1988). The wood base of the crib is considered a collapse hazard (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

This crib received 8,520,000 L (2,251,000 gal) of scavenged tributyl phosphate waste from the 221-U Building in March and April 1956. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Fecht et al. 1977;

Brown et al. 1990). The crib was deactivated by valving out the feed pipe to the crib when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979).

The soil overlying the 216-B-18 Crib was discovered to have collapsed approximately 0.3 m (1 ft), with no exposure of the crib to the air during a field inspection in February 1974. The collapse was filled with gravel (Maxfield 1979). Since the wooden cribs should have a service life of about 25 years, all of the cribs in this area, as well as the wood-covered trenches described below, are considered to be potential collapse hazards.

2.3.3.11 216-B-19 Crib. The 216-B-19 Crib is located southwest of the 216-B-16 Crib. It is an inactive waste management unit. This crib is a 3 x 3 x 1 m (10 x 10 x 3 ft) structure made of wood, concrete blocks, and steel, placed over a 1.5 m (5 ft) thick gravel bed and is fed by a 36 cm (14 in.) steel pipe 2 m (6 ft) below grade (Maxfield 1979; DOE 1988; Stenner et al. 1988). The wood base of the crib is considered a collapse hazard (Ortiz 1974). The bottom of the excavation is 12 x 12 m (40 x 40 ft) (DOE/RL 1991a).

This crib received 6,400,000 L (1,700,000 gal) tributyl phosphate waste from the 221-U Building from February 1957 until October 1957. The waste is high salt and neutral/basic. The waste contained inorganic compounds such as ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides in the waste stream deposited in these cribs contained ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Fecht et al. 1977; Brown et al. 1990). The crib was deactivated by valving out the feed pipe to the crib when the calculated specific retention of the underlying soil column was achieved (Maxfield 1979).

2.3.3.12 216-B-43 Crib. The 216-B-43 through 216-B-50 Cribs are inactive waste management units located adjacent to the northern boundary of the 241-BY Tank Farm (200-BP-1 Operable Unit). Each crib received scavenged tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. These cribs consist of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) ft long, placed 2 m (7 ft) below grade, and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). A cross section and plan view of the 216-B-43 through -50 Cribs can be found on Figure 2-23.

The 216-B-43 Crib received 2,100,000 L (554,000 gal) of waste in November 1954. Maxfield (1979) reports that the crib was taken out of service when the specific retention capacity of the soil under the crib was reached. The *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that all of the cribs in this series except the 216-B-43

Crib received volumes beyond their specific retention capacity. Dates of operation and radiological and chemical inventories are presented in Tables 2-1, 2-3, and 2-4.

Tributyl phosphate acid waste from the 221-U Building was made alkaline for transport, and sent to the 241-BY Tank Farm, where it was treated with potassium ferrocyanide as a cesium scavenger. The supernatant from the tanks was allowed to cascade, to allow precipitation of cesium, and was then discharged to the 216-B-43 through 216-B-49 Cribs (DOE/RL 1990a; Jungfleisch 1984). The eight cribs in this group are arranged in two, north trending lines of four cribs each; two lines run north from the 201-B Flush Tank, and individual feed pipes extend out, perpendicular to the central lines to the individual cribs.

Inorganic compound in the liquids disposed to these cribs include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

Stabilization of the crib area began in 1975 and was completed in November 1977. Stabilization activities included removal of radioactive vegetation, removal and blanking of all crib vent risers below grade, removal of a buried radioactive spill adjacent to the 216-B-43 Crib, extension of all monitoring well casings above grade, grading of crib site surface, placement of two 3 x 30 m (10 x 100 ft) test strips treated with lithium chloride (to determine effectiveness of root barrier), addition of 15 cm (6 in.) of sand over a 10 mil plastic root barrier, and addition of at least 30 cm (12 in.) of topsoil seeded with cheatgrass and Siberian wheatgrass treated with the herbicide urea borate (Maxfield 1979).

In 1991 the area around the 216-B-43 to -50 and 216-B-57 Cribs was interim stabilized. This was done to eliminate surface contamination and migration deficiencies and to maintain environmental compliance until the final remediation strategy is implemented. Stabilization activities included removing debris, resurveying, conspicuously marking all above-grade structures, covering contaminated areas with cobble, rock, and clean soil, and reposting the area as underground radioactive material.

2.3.3.13 216-B-44 Crib. The 216-B-44 Crib is located north of the 216-B-43 Crib, and received 5,600,000 L (1,500,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, placed 2 m (7 ft) below grade, and set on a 1.5 m (5 ft) bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). It received waste from November 1954 until March 1955.

Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to the crib include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

2.3.3.14 216-B-45 Crib. This crib is located north of the 216-B-44 Crib, and received 4,900,000 L (1,300,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) diameter and 1.2 m (4 ft) long, placed 2 m (7 ft) below grade, and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). It was active from April until June 1955. Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; Brown et al. 1990)

2.3.3.15 216-B-46 Crib. The 216-B-46 Crib is located north of the 216-B-45 Crib, and received 6,700,000 L (1,800,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, placed 2 m (7 ft) below grade, and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). It received waste from September until December 1955. Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

2.3.3.16 216-B-47 Crib. The 216-B-47 Crib is located west of the 216-B-43 Crib, and received 3,700,000 L (980,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, the are placed 2 m (7 ft) below grade, set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). It was active only in September 1955. Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990).

2.3.3.17 216-B-48 Crib. The 216-B-48 Crib is located west of the 216-B-44 Crib, and north of the 216-B-47 Crib. It received 4,100,000 L (1,100,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, placed 2 m (7 ft) below grade and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). The unit received waste in November 1955. Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

2.3.3.18 216-B-49 Crib. The 216-B-49 Crib is located west of the 216-B-45 Crib, and north of the 216-B-48 Crib. It received 6,700,00 L (1,800,000 gal) of tributyl phosphate supernatant waste from the 221-U Building and 241-BY tanks. The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 (4 ft) in diameter and 1.2 (4 ft) long, placed 2 m (7 ft) below grade, and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 m x 4.6 m x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). The crib was active in November and December 1955. Maxfield (1979) reports that the feed pipe to the crib was valved out when the specific retention capacity of the soil under the crib was reached, but the *RI/FS Work Plan for the 200-BP-1 Operable Unit* (DOE/RL 1990a) states that the crib received volumes beyond its specific retention capacity.

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

2.3.3.19 216-B-50 Crib. The 216-B-50 Crib is located west of the 216-B-46 Crib, and north of the 216-B-49 Crib. It received 54,800,000 L (14,500,000 gal) of waste storage tank condensate from the ITS-1 unit in the 241-BY Tank Farm (Maxfield 1979). The crib, currently inactive, consists of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, placed 2 m (7 m) below grade, and set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m) (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a). The feed pipe was valved out when the specific retention capacity of the soil was reached (Maxfield 1979).

Inorganic compounds in the liquids disposed to the crib include ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained within the waste stream sent to these cribs include ^{137}Cs, ^{90}Sr, ^{106}Ru, plutonium, and uranium (Maxfield 1979; WHC 1991a; Brown et al. 1990)

The 216-B-50 Crib did not receive waste until January 1965 due to elevated ^{60}Co and ^{137}Cs levels in groundwater. In 1956, a nearby monitoring well had ^{60}Co levels over 300 times the Hanford Atomic Products Operation (HAPO) limit. The decision to use the 216-B-50 Crib for ITS system condensate was made following 8 to 9 years of observations when it was shown that the groundwater activity levels were definitely decreasing.

From January 1965 until January 1974 the 216-B-50 Crib received 54,800,000 L (14,500,000 gal) of waste storage tank condensate from the ITS-1 unit in the 241-BY Tank Farm. Discharge to the crib was about 19 to 23 L/min (5 to 6 gal/min) of condensate. Around 1968 the capacity of ITS-1 was doubled (Project ICE-618). The quantity of waste generated (about 45 L/min, 12 gal/min) was now greater than the designed disposal rate (19 to 23 L/min, 5 to 6 gal/min) of the 216-B-50 Crib. This created concern that an increase in water level could drive the condensate through the highly contaminated zone under the other seven cribs. Chemical data obtained from monitoring wells showed condensate sent to the 216-B-50 Crib tended to migrate beneath the highly contaminated cribs. The 216-B-50 Crib was to be taken out of operation when the calculated specific retention capacity of the underlying soil column was achieved, but may have been retired prematurely due to "size" limitations and because of its close proximity to the highly contaminated the 216-B-43 through 216-B-49 Cribs used for scavenged tributyl phosphate waste.

2.3.3.20 216-B-55 Crib. The 216-B-55 Crib is an active 230 m (750 ft) long waste disposal unit located approximately 200 m (600 ft) west of the 221-B Building. It is 230 m (750 ft) long, 3 m (10 ft) wide, and 4 m (12 ft) deep. It is composed of a perforated 30 cm (12 in.) pipe that runs the length of the unit 1 m (3 ft) above the bottom. The excavation is filled with gravel, and has side slopes of 1.5:1 (DOE/RL 1991a).

The crib became operational in September 1967 (Maxfield 1979). It was designed to receive low-level liquid wastes (steam condensate) from the 221-B Building. Radioisotopes present within the waste stream include ^{211}Am, ^{137}Cs, ^{131}Pu, ^{106}Ru, ^{90}Sr, and ^{3}H (Brown et al. 1990; WHC 1991a). Although still active, this unit has not received any effluent for the last 3 to 4 years (see Section 2.4.3).

2.3.3.21 216-B-56 Crib. The 216-B-56 Crib, located approximately 150 m (500 ft) north of 7th Street near the center of the operable unit, was designed to receive organic wastes from the 221-B Building but the pipeline to the unit was not installed when disposal practices were changed and discharge of organic wastes to the ground was prohibited (Lundgren 1979; Maxfield 1979). The unit is 21 m (70 ft) long and 3 m (10 ft) wide. It is a gravel filled crib and is, presumably, similar in construction to cribs 216-B-55 and 216-B-57. The crib was surveyed and downposted due to cross-contamination from surrounding sites.

2.3.3.22 216-B-57 Crib. The 216-B-57 Crib is an inactive waste management unit located adjacent to the northwest corner of the 241-BY Tank Farm. It is 60 m (200 ft) long, 4.6 m (15 ft) wide, and 3 m (10 ft) deep, and is composed of a perforated, 30 cm (12 in.) diameter pipe that runs the length of the unit, 1 m (3 ft) above the bottom. The site is filled with gravel to 1.2 m (4 ft) above the bottom. From February 1968 to June 1973 84,400,000 L (22,300,000 gal) of waste storage tank condensate from the ITS-2 unit of the 241-BY Tank Farm were disposed at this crib. Inorganic liquid waste was also deposited to this trench and consisted primarily of aluminum carbonate. Radionuclides contained in the waste stream include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (WHC 1991a; Brown et al. 1990).

In 1991 surface contamination in the areas around the 216-B-43 through 216-B-50 and 216-B-57 Cribs was interim stabilized to achieve environmental compliance in preparation for the RI/FS work activities currently underway. The areas were then re-posted with underground radioactive material warning signs (prior to remedial activities, the crib areas were posted with surface contamination signs). Recent drilling activities at the crib areas required that the units be re-posted with surface contamination warning signs.

Currently, the area is about 1 m (2 ft) above grade and covered with gravel. A 15 cm (6 in.) steel vent pipe is located at each end. The north vent extends about 91 cm (36 in.) above grade and has a 39 x 39 x 39 cm^2 (6 x 6 x 6 in.^{2}) filter box.

2.3.3.23 216-B-60 Crib. The 216-B-60 Crib consists of two steel vertical cascading caissons positioned side by side. The two caissons are 2.4 m (8 ft) in diameter, 5 m (16 ft) long and bottom at 12 m (40 ft) depth. They are covered by 46 cm (18 in.) thick concrete tops. They are located 1.2 m (4 ft) west of the 221-B Building. In 1975, an extension to the 221-B Building was added covering the crib. The cribs are currently under the northeast corner of the 225-B Encapsulation Facility (Maxfield 1979; Stenner et al. 1988). This waste management unit is inactive.

The crib was specifically built for solid and liquid wastes generated from the clean-out of the 221-B Building cell drain header that took place November 1967. The calculated total plutonium and fission product discharged to the site is 715.5 kg (1,577.4 lb) of uranium, 0.08 g of plutonium, 777 Ci of ^{144}Ce, 8 Ci of ^{137}Cs, and 5 Ci of ^{154}Eu (WHC 1991a).

After the drain header clean-out was completed, the caissons were plugged with 46 cm (18 in.) of concrete to seal the waste. The area was backfilled to grade and in 1975 the 225-B Encapsulation Facility was built over the crib (Stenner et al. 1988).

2.3.3.24 216-B-61 Crib. The 216-B-61 Crib was designed to receive waste storage tank condensate from the ITS system No. 1 unit in the 241-BY Tank Farm and is located about 150 m (500 ft) northwest of the tank farm. This crib was designed to replace the 216-B-50 Crib, which could not handle the increased capacity from the ITS No. 1 unit when it was modified in 1968. Although this crib was built, it was never used (WHC 1991a). It is known that this crib is gravel filled and covers 163 m^2 (1,750 ft^2); however, individual dimensions could not be determined. Its design is presumed to be similar to the 216-B-57 Crib. It is listed in the WIDS database as containing nonhazardous nonradioactive material.

The 216-B-61 Crib is enclosed in a light weight chain barricade with a placard indicating a crib. A concrete identification post stands at the head of the crib and two risers appear above the ground surface near the west end of the crib.

2.3.3.25 216-B-62 Crib. The 216-B-62 Crib is active and located 460 m (1,500 ft) northwest of the 221-B Building and has received low-level process condensate from the 221-B Building Separations Facilities. Although active, the unit has not received effluent in the last 3 to 4 years (see Section 2.4.3). The crib is 150 m (500 ft) long, 3 m (10 ft) wide (Maxfield 1979), and consists of a perforated 15 cm (6 in.) diameter fiberglass reinforced epoxy distributor pipe that runs the length of the crib, approximately 3 m (10 ft) below grade. It is a gravel filled crib. Americium-241, ^{137}Cs, ^{106}Ru, ^{90}Sr, and ^{239}Pu are radionuclides present within the waste stream (Brown et al. 1990; WHC 1991a).

2.3.3.26 Chemical Tile Field North of 2703-E Hazardous Waste Staging Area. The chemical tile field is an active waste management unit located about 250 m (800 ft) north of 4th Street and 60 m (200 ft) west of Baltimore Avenue. The tile field may have received mixed waste from an unknown source while in operation. Little information is available about this unit (WHC 1991a).

2.3.3.27 216-B-13 French Drain. The 216-B-13 French Drain is located 100 m (300 ft) south of the 221-B Building and 8 m (25 ft) northeast of the 291-B-1 Stack. The unit consists of two 1.2 m (4 ft) by 1.5 m (5 ft) tall tile pipe sections stacked vertically and filled with 2,270 kg (2.5 tons) of crushed limestone. A piece of plywood covers the top of the drain 2.4 m (8 ft) below grade. Site dimensions are 1.2 m (4 ft) diameter by 5.5 m (18 ft) deep. It is inactive. The french drain received 28,000 L (7,400 gal) of 291-B-1 Stack drainage. The mixed liquid waste was low in salt and neutral/basic, and the french drain contains less than 0.004 g/m^3 potential plutonium. The unit operated from August 1947 through June 1976. Prior to August 1947, 291-B Stack drainage was disposed in the 216-B-4 Reverse Well. In June 1976, the stack drainage was rerouted into a cell drainage sample tank. The WIDS lists only 2,000 kg (5,000 lb) of nitrate contained within the waste stream disposed by this unit (WHC 1991a).

The top of the structure is buried 2.4 m (8 ft) below grade. It is marked by a yellow concrete post. A depression in the soil 2.4 m (8 ft) from the marker could be due to the collapse of the plywood which covered the drain.

2.3.3.28 216-B-51 French Drain. This is an inactive waste management unit located about 230 m (750 ft) north of the 241-B Tank Farm. It received waste from January 1956 until January 1958. The unit consists of vertically stacked sections of 1.5 m (5 ft) diameter concrete pipe filled with gravel. The bottom of the unit is 4.3 m (14 ft) below grade and the top is 0.3m (1 ft) below grade with a treated wood cover. The unit dimensions are 1.5 m (5 ft) in diameter by 4.3 m (14 ft) in depth.

The drain received about 1,000 L (260 gal) of flush drainage from the BC Crib pipeline. The pipeline carried high salt neutral to basic scavenged tributyl phosphate waste from the 221-U Building to the BC Crib area. The french drain contains less than 10 Ci of total beta activity (Stenner et al. 1988). The unit has a plywood cover (WHC 1991a) and may represent a collapse potential.

2.3.4 Reverse Wells

Reverse wells are injection wells drilled to a depth slightly above the water table. In the early years of the Hanford operation, they were used to dispose of liquid waste. Sources of waste disposed to these wells is shown in Table 2-1. The locations of these reverse wells are shown on Figure 2-4.

2.3.4.1 216-B-4 Reverse Well. The 216-B-4 Reverse Well is located about 250 m (800 ft) southeast of the 221-B Building and west of the 292-B Building. It is 20 cm (8 in.) in diameter, and 33.5 m (110 ft) deep. The structure received 10,000 L (2,700 gal) of low salt, neutral/basic, TRU fission waste during its operational lifetime of April 1945 through December 1949. Until August 1947, the reverse well received 291-B Stack drainage. After August 1947, the reverse well received floor drainage from the 292-B Building. The WIDS hazardous chemical inventory lists only 1,000 kg (2,000 lb) of nitric acid contained in the waste stream. A radionuclide inventory was not available. However, it is estimated that the waste contained less than 1 Ci total beta (Maxfield 1979). The pipeline to the unit has been disconnected (Stenner et al. 1988).

2.3.4.2 216-B-5 Reverse Well. The 216-B-5 Reverse Well is an inactive, 92 m (302 ft) deep, 20 cm (8 in.) diameter (Brown and Ruppert 1950), waste management unit located about 300 m (1,000 ft) northeast of the 221-Building and east of Baltimore road. It received overflow waste from the 241-B-361 Settling Tank, which received waste from the 224-B Concentration Facility and from Tank 5-6 in the 221-B Building from April 1945 until September 1946. Between September 1946 and October 1947 cell drainage and other liquid waste from Tank 5-6 was injected into the well (WHC 1991a; Brown et al. 1990). Approximately 31,000,000 L (8,100,000 gal) of liquid were discharged to the 216-B-361 Settling Tank from the 224-B Concentration Facility and the 221-B Building, containing an estimated 4,275 g of plutonium and 3,800 Ci of beta-gamma activity (Brown and Ruppert 1950).

In 1947 the elevation of the water table in Well E33-18 demonstrated that the reverse well penetrated about 3 m (10 ft) into the groundwater and that radioactive waste had been discharged into the groundwater. The 216-B-5 Reverse Well was deactivated and the Tank 5-6 wastes were rerouted to the 216-B-7A and -7B Cribs (Maxfield 1979). Figure 2-25 shows the general arrangement of the 216-B-5 Reverse Well.

2.3.4.3 216-B-6 Reverse Well. The 216-B-6 Reverse Well is located 4 m (12 ft) west and 1 m (3 ft) north of the northwest corner of the 222-B Building and is marked by a 1.2 m (4 ft) concrete identification post. It was constructed of 15-cm (6-in) diameter stainless steel pipe at a 23-m (75-ft) depth. The lower 8 m (25 ft) are perforated at every 0.3 m (1 ft) with 1-cm (0.5-in) holes.

Six million liters (2,000,000 gal) of mixed liquid waste was received by the reverse well from April 1945 through December 1949. The waste was acidic (containing nitric and sulfuric acid) and radioactive (containing TRU fission products) and came from decontamination and sample slurper waste from the 222-B Building. Use of this well was terminated when it was determined that the radionuclide capacity had been reached (Maxfield 1979). The 216-B-6 Reverse Well contains less than 10 Ci of total beta.

2.3.4.4 216-B-11A and 216-B-11B Reverse Wells. The 216-B-11A and 216-B-11B Reverse Wells are inactive waste management units located approximately 76 m (250 ft) north of the 241-B Tank Farm. These two wells are placed about 18 m (60 ft) apart in line with a 7.6 cm (3 in.) steel inlet pipe. The wells are pipe-encased, have a 1.2 m (4 ft) diameter and are 12.2 m (40 ft) deep.

From December 1951 to December 1954 approximately 29,600,000 L (7, 820,000 gal) of low salt, neutral to basic process condensate from the 242-B Evaporator were disposed of at these units. Radionuclides contained in the waste stream at the time of discharge included 50 Ci of ^{137}Cs, 5 Ci of ^{90}Sr, 50 Ci of ^{106}Ru, 0.4 g of plutonium, and 14 kg of uranium (Maxfield 1979). These contaminants were distributed between the two reverse wells. The majority of it is probably in the 216-B-11A Reverse Well (Maxfield 1979).

The reverse wells were deactivated when it became evident that cribs and trenches were more effective means of disposal. The supply lines were blanked and capped. The most recent radiological survey of these units identified a collapse potential, apparently created by wooden covers on the top of the wells.

2.3.5 Ponds, Ditches, and Trenches

The ponds and trenches in the B Plant Aggregate Area were designed to percolate waste liquid into the ground. The ponds in the B Plant Aggregate Area include the 216-A-25 Pond (Gable Mountain Pond), 216-N-8 (West Lake), and the 216-B-3 Pond System, which consists of a main pond and three interconnected expansion lobes. The expansion lobes are referred to as the 216-B-3A, 216-B-3B, and 216-B-3C Ponds. Several ditches designed to convey cooling water are also associated with the pond systems. Trenches were excavations that were opened for discrete time intervals for subsurface disposal of liquid waste, then backfilled. In "specific retention" trenches, a specified volume of liquid was discharged to the trench and would be held by capillary action in the soil column. Table 4-4 compares the volume of waste discharged to a unit with its calculated specific retention capacity. The B Plant Aggregate Area trenches were excavated to absorb scavenged tributyl phosphate waste (waste from tributyl phosphate solvent extraction process in the U Plant Aggregate Area where uranium, cesium, and strontium was recovered from aqueous B Plant Aggregate Area bismuth phosphate waste) and waste from the Plutonium Recycle Test Reactor in the 300 Area (Maxfield 1979). The locations of the ponds, ditches, and trenches are shown on Figures 2-5, 2-6, and 2-7.

2.3.5.1 216-B-3 Pond/UN-200-E-14. The 216-B-3 Pond is approximately 1,100 m (3,500 ft) east of the 200 East Area perimeter fence and about 1,500 m (5,000 ft) northeast of the 202-A Building. It is roughly rectangular, currently covers a surface area of about 35 acres, and is between 0.6 to 6 m (2 to 20 ft) deep. Historical records indicate that throughout its operational lifetime, the 216-B-3 Pond has varied in size from approximately 19 to 46 acres. The east end of the pond is formed by a dike 420 m (1,380 ft) long, 12.8 m (42 ft) wide, and 10.6 m (35 ft) high. The dike extends approximately 1.5 m (5 ft) above the water level. An area of approximately 4.1 acres immediately west of the 216-B-3 Pond was diked during the 1970's to provide an overflow area for the 216-B-3 Pond. This overflow area was decommissioned and backfilled in 1985.

The 216-B-3 Pond, a RCRA facility, has been operational since April 1945 (Maxfield 1979). A Closure/Postclosure plan (DOE/RL 1990b) has been prepared for the pond system, but has not yet been approved by the Department of Ecology. During its lifetime, the 216-B-3 Pond has received mixed waste via the 216-A-29 Ditch and the PUREX Cooling Water Line in the PUREX Aggregate Area. From the B Plant Aggregate Area, the pond has received waste from the 216-B-2-1, 216-B-2-2, and 216-B-2-3 Ditches, the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches, and the current 216-B-2-3 pipeline. A pipeline connects the B-2 ditches (and current 216-B-2-3 pipeline) to the past and present B-3 Ditches. This pipeline falls within the PUREX Plant Aggregate Area 200-PO-6 Operable Unit.

Currently, effluent streams reach the 216-B-3 Pond System through two means of conveyance, a pipeline from the 207-B Retention Basin at B Plant, which carries effluents from B Plant and runs along the route of the 216-B-2-3 Ditch, and a pipeline from the PUREX Plant Aggregate Area called the PUREX Cooling Water Line. Both of these pipelines discharge into the western end of the 216-B-3-3 Ditch which drains into the 216-B-3-3 Ditch which drains into the 216-B-3 Pond. Plates 1 and 4, and Figure 2-6 show the location of these facilities. Effluent streams which reach the 216-B-3 Pond System through the pipeline from B Plant include B Plant Cooling Water (CBC) and, since February 1992, the B Plant Chemical Sewer (BCE). Effluents which reach the pond through the PUREX Cooling Water Line include 284-E and 283-E effluent, PUREX Cooling Water (CWL), PUREX Chemical Sewer (CSL) effluent, and cooling water effluents from the 244-AR Vault, the 241-A Ventilation System Complex, and the 242-A Evaporator. The effluents which are conveyed by the PUREX Cooling Water Line are described in the PUREX Aggregate Area Management Study Report with the exception of the 284-E and 283-E effluents which are described in Section 2.3.1.1.8 and 2.3.1.1.9. The 216-B-63 Trench serves as an emergency backup discharge point for the streams which pass through the B Plant pipeline. The 216-B-3 Pond System received an estimated total waste volume of 240,000,000,000 L (63,408,000,000 gal) between 1945 and 1991 (WHC 1991a).

The steam condensate and cooling water that reaches the pond is primarily river water with little potential for chemical or radioactive contamination, and comprise the bulk of the water used in the 200 East Area. Releases into this stream have occurred but represent a small fraction of the waste volume discharged to the pond. Other liquid wastes that have been discharged in low volume to the pond may contain potentially hazardous substances (Luttrell et al. 1989).

Several hazardous, nonradioactive discharges have reached the 216-B-3 Pond through the 216-A-29 Ditch. Compounds in these CERCLA-reportable releases include: demineralizer regenerant, aqueous makeup tank heels and off-specification batches; N cell prestart testing (oxalic acid, nitric acid, hydrogen peroxide, calcium nitrate); potassium permanganate; sodium carbonate solution; hydrazine HN solution; potassium hydroxide; sodium nitrate; nitric acid; sodium hydroxide; cadmium nitrate; hydrazine; and sodium nitrite. The demineralizer regenerant, aqueous makeup tank heels, and off-specification batches and compounds were released from 1955 to 1987. Other compounds were released in discrete events from the early to late 1980's (Luttrell et al. 1989).

There is one known unplanned release directly associated with this pond: UN-200-E-14. Unplanned release UN-200-E-14 occurred in 1958 when a dike on the east side of the 216-B-3 Pond ruptured and released contaminated water into a ravine east of the pond. The contaminated area was covered with clean soil and was removed from radiation zone status in December 1970.

In addition to the one unplanned release directly associated with the 216-B-3 Pond, there have been four other unplanned releases which have released contamination into the ditches and ultimately reached the 216-B-3 Pond. These unplanned releases, UPR-200-E-32, UPR-200-E-34, UPR-200-E-51, and UPR-200-E-138, are described in Sections 2.3.5.9, 2.3.5.12, 2.3.5.14, and 2.3.5.10.

2.3.5.2 216-B-3A Pond. The 216-B-3A and -3B Ponds were built in 1983 to handle the increased discharge flowrate resulting from the restart of the 202-A Building operations. In January 1984 the dike separating the 216-B-3A and -3B Ponds was breached at the dike spillway and pond use was halted. The failure was attributed to erosion of sediments (channeling) around and underneath the concrete-lined channel connecting the two lobes. A slide gate, a duplicate of the 216-B-352 slide gate on the 216-B-3 Pond, was built and the ponds were reopened for use.

The 216-B-3A Pond is an active waste management unit covering about 10 acres and appears to be shallow, about 1 m (2 to 3 ft) deep. It receives water from the 216-B-3 Pond via the 216-B-352 overflow structure. The surface elevation of this pond is approximately 6 m (18 ft) lower than the 216-B-3 Pond. It has two outflow structures at its eastern end. One of these structures can release water to the 216-B-3B Pond and one can release water to the 216-B-3C Pond. The pond has a very low infiltration rate. This could be due to siltation, algae growth, and wind-blown sedimentation. Migration of bentonite from the 216-B-3 Pond is another possibility, even though there was a 13 year gap between the last known use of bentonite in the 216-B-3 Pond and the startup of the 216-B-3A lobe.

Following the dike break, a north-south trending ditch, 1.8 m (6 ft) deep, 6 m (20 ft) wide, and approximately 244 m (800 ft) long, was excavated into the bottom of the 216-B-3A lobe to improve percolation.

2.3.5.3 216-B-3B Pond. This pond was returned to service in June 1984, after the dike repair. It is roughly rectangular and is currently dry. It has been unused since 1985, and was dredged in 1986. Up to 2 m (7 ft) of material was removed in the dredging process to level the bottom of the pond. The removed material was placed along the north shore of the 216-B-3 Pond. It is listed as an active waste management unit (WHC 1991a).

The 216-B-3B lobe is surrounded by "Danger" warning signs. However, these are due to Ecology requirements and there is no indication of actual contamination. The whole pond is surrounded by a light chain barricade and there is a second light chain barricade surrounding the inlet ditch. It is posted with surface radiation contamination warning signs.

2.3.5.4 216-B-3C Pond. This pond has been active since its construction in 1985. It was built to handle increased discharge to the 216-B-3 Pond system arising from the decommissioning of the Gable Mountain Pond. Unlike the other ponds which were formed by blocking off a topographic low with an embankment, this lobe was completely excavated into the ground so that there was no possible chance of embankment failure. The excavation was done in a coarse gravel layer to increase the infiltration rate. Within the roughly rectangular depression of the pond, there are a series of distribution channels running the length of the pond bottom. This is the lowest elevation pond in the 216-B-3 Pond series. Eventually, the 216-B-3C Pond will become the main disposal pond in the 216-B-3 Pond system although under the current low flow conditions, most of the inflow can percolate through the 216-B-3 and -3A Ponds.

2.3.5.5 216-E-28 Contingency Pond. The 216-E-28 Contingency Pond is approximately 30 acres in size and is divided into three lobes. It was built to receive effluents and is being held in reserve for any future embankment failures. It was built in 1986 and has never been used. Along with the pond, a pipeline approximately 915 m (3,000 ft) long was built to connect the contingency pond to the various suppliers to the 216-B-3 Pond system. From this pipeline, an extension has been added so that there is now a pipeline connection around the 216-B-3 Pond's main lobe. Effluent will be diverted into the 216-B-3A Lobe when the 216-B-3 Pond's Closure/Postclosure Plan is implemented. Bypass pipelines around the 216-B-3A Lobe to the 216-B-3B and 216-B-3C Lobes are in the design phase.

2.3.5.6 216-A-25 Gable Mountain Pond. The 216-A-25 Gable Mountain Pond was a 71 acre natural depression located 1.6 km (1 mi.) south of the west end of Gable Mountain. It was the largest seepage disposal facility of the several Hanford ponds. In 1957 it was commissioned for service to receive cooling water from the 202-A Building. Gable Mountain Pond routinely received low level liquid wastewater from the 202-A Building, the 242-A Evaporator, the 244-AR Vault, 200 East Area Powerhouse, and the 241-A Tank Farm (WHC 1991a). Waste reached Gable Mountain Pond through the PUREX Cooling Water line. This pipeline, made of corrugated metal, was broken and capped when the Gable Mountain Pond was decommissioned in 1987. Between its commissioning in 1957 and its decommissioning in 1987, the pond received approximately 307,000,000,000 L (8,110,000,000 gal) of liquid mixed waste (Coony and Thomas 1989). The radionuclides contained in the waste streams disposed at this site include ^{241}Am, ^{3}H, ^{106}Ru, ^{137}Cs, ^{147}Pm, ^{90}Sr, and plutonium (Brown et al. 1990; WHC 1991a).

Although the pond has received low levels of chemically and radioactively contaminated wastes since its startup, a single unplanned release (UPR-200-E-34) on June 11, 1964 resulted in relatively large quantities of short and long-lived mixed fission products to 216-B-3 Pond, Gable Mountain Pond, and the ditch associated with 216-B-3 Pond (216-B-3-1 Ditch). Bentonite clay was introduced to the pond bottom as an attempt to tie-up radionuclides in the upper sediment layers after the release (Maxfield 1979). Copper sulfate was added on two occasions to eliminate the algae and invertebrate life, thus breaking the important links in the food chain of the migratory water fowl. The desired water concentration was 3 p/m (Maxfield 1979).

Clean-up actions were started in July 1984. The stabilization was completed in December 1988. The unit was backfilled with clean pit run soil and cobbles to a minimum of 1 m (2 ft) above the original shoreline (Hayward 1989). The pond was re-vegetated after a 0.3 m (1 ft) layer of topsoil was spread over the entire backfilled area. Wells 699-53-47, 699-55-50C, and 699-52-52 monitor the groundwater beneath the site of the backfilled pond (WHC 1991a).

2.3.5.7 216-N-8 Pond. Also known as "West Pond" or "West Lake", the 77,800 m^2 216-N-8 Pond serves as a natural basin for a large watershed area. It is located 1.2 km (75 mi) northwest of Gable Mountain Pond, and was an intermittent seasonal unit prior to expanding Gable Mountain Pond use.

After Gable Mountain Pond started receiving large volumes of wastewater in 1958, the water table was raised in the general area and the 216-N-8 Pond became permanent. Although it was never directly used as waste disposal unit, it contains relatively high amounts of radionuclides having the highest gross alpha concentrations of all the 200 Areas ponds (Strait and Moore 1981). The actual source of the contamination is unknown. Prior to the existence of the 216-N-8 Pond, the area was used as a sewage sludge disposal site for the early Hanford construction camp. Consequently high levels of alkalinity and phosphate have been measured in the pond, which are attributed to the sewage sludge disposal.

2.3.5.8 2101-M Pond. Located in the 200-SS-1 Operable Unit near the 200-E Steam Plant, the 2101-M Pond became operational in 1953 and receives small volumes of steam condensate and overflow drain wastewater from the 2101-M Building heating and air conditioning system. In addition, the pond has received barium chloride laboratory waste solutions estimated at less than 2,000 L/yr (500 gal/yr), and 1 to 10 kg/yr (2 to 22 lb) of nitric and hydrochloric acid. The pond is a RCRA waste management unit and an application for closure has been submitted. The closure plan has been prepared, sampling has been completed, and closure is awaiting regulatory approval The pond is encompassed by a light-weight chain barricade with "RCRA WASTE SITE DO NOT DISTURB," and "DRY ROT" warning signs. The pond is covered with heavy vegetation and a few small trees. Two berms of soil, trending east-west, lie on either side of the pond.

2.3.5.9 216-B-2-1 Ditch/UPR-200-E-32. The 216-B-2-1 Ditch is the northernmost of the three ditches (216-B-2-1, 216-B-2-2, and 216-B-2-3). It was an open ditch 4.6 m (15 ft) wide at ground level, 1.8 m (6 ft) deep, and approximately 1,067 m (3,500 ft) long. Operational from April 1945 to November 1963, the ditch conveyed steam condensate, process cooling water, and chemical sewer from the 221-B Building and water from the

284-E Powerhouse to the 216-B-3 Pond via the 216-B-3-1 Ditch (Maxfield 1979). From March 1952 until its closing, it also conveyed 241-CR Vault cooling water (DOE/RL 1991a).

The 216-B-2-1 Ditch was closed after the unplanned release UPR-200-E-32 occurred. In November 1963, a coil leak developed in the 221-B Building 6-1 Tank, which stored the cesium-rare earth fraction of the fission product stream. The leak caused gross contamination of the 207-B Water Retention Basin and the head end of this ditch. After damming the 216-B-2-1 Ditch 300 m (1,000 ft) from its head, the contaminated basin water was flushed into the ditch. The total volume of liquid to be discharged to the ditch during this incident was estimated to be 4,900,000 L (1,300,000 gal) 4,200,000 L (1,100,000 gal) of which were low activity level cooling water. A sample was taken and analyzed to estimate the amount of activity released. The ^{141}Cs content was determined insignificant. Only ^{144}Cs (30 Ci) and ^{90}Sr (0.05 Ci) were considered pertinent (Maxfield 1979). Another source estimated that less than half a liter of highly contaminated waste from the 221-B Building 6-1 tank contents was discharged to the retention basin (Maxfield 1979).

2.3.5.10 216-B-2-2 Ditch/UPR-200-E-138. The 216-B-2-2 Ditch was built to replace the 216-B-2-1 Ditch, and was active from November 1963 to May 1970. It was an open ditch approximately 4.6 m (15 ft) wide at ground level, 1.8 to 2.4 m (6 to 8 ft) deep at the upper end, and 1,067 m (3,500 ft) long. Until January 1965, it transported and percolated the 284-E Powerhouse waste, 241-CR Vault cooling water, 221-B Building cooling water and steam condensate, and chemical sewer to the 216-B-3 Pond. From January 1965 until November 1967, it also carried the 241-BY ITS Unit cooling water. Until February 1968, it transported 241-CR Vault cooling water and the 221-B Building cooling water without the 284-E Powerhouse waste and the steam condensate. Until April 1970, the site received cleanup waste from 207-B Retention Basin.

Unplanned release UPR-200-E-138 occurred on March 22, 1970. An estimated 1,000 Ci ^{90}Sr release occurred while attempting to measure the liquid level of product storage tank 8-1. The waste was sprayed with several small water hoses down the 221-B Building floor drain and chemical sewer, that led to the 216-B-2-2 Ditch and the 216-B-3 Pond (Maxfield 1979). The 207-B Retention Basin was bypassed and was not contaminated as a result of this unplanned release. On March 23, 1970, earthen dams were built to keep as much contamination out of the 216-B-3 Pond as possible. Radiation levels of 500 R/h 7.6 cm (3 in.) from the pipe gallery existed. Water samples from the 216-B-3 Pond reached a maximum ^{90}Sr concentration of 1.7 x 10^{-3} μCi/ml (Maxfield 1979).

After this release, the piping from the 221-B Building was flushed to the 216-B-2-2 Ditch. It was then backfilled and a new ditch, the 216-B-2-3 Ditch, was excavated parallel and south of the entire length of the old ditch. Cooling water was then routed through the new ditch.

2.3.5.11 216-B-2-3 Ditch. The 216-B-2-3 Ditch replaced the 216-B-2-2 Ditch after the ^{90}Sr leak in 1970 (Maxfield 1979). It was an open ditch approximately 6 m (20 ft) wide at ground level, 1.8 to 2.4 m (6 to 8 ft) deep and the upper end, and 1,219 m (4,000 ft) long. Until 1973, it carried and percolated 241-CR Vault cooling water, 221-B Building cooling water, and condenser cooling water from the 241-BY Tank Farm ITS-1 and ITS-2 units. After 1973, the ditch no longer carried the condenser cooling water from the 241-BY Tank Farm ITS-1 and ITS-2 units. It was backfilled and replaced with a parallel polyethylene pipeline west of the 218-E-12A Burial Ground in 1987 (WHC 1991a). A corrugated metal pipeline located at the east end of the 216-B-2 Ditches has been in place since 1945 to carry the waste stream from the 216-B-2 Ditches to the 216-B-3 Ditches. This underground pipeline is approximately 550 m (1,800 ft) long. The area is posted as an underground radioactive material zone.

2.3.5.12 216-B-3-1 Ditch/UPR-200-E-34. The 216-B-3-1 Ditch was in service from April 1945 to July 1964 (Stenner et al. 1988). It was 975 m (3,200 ft) long, 1.8 m (6 ft) wide, and approximately 1.8 m (6 ft) deep. It carried mixed waste (Maxfield 1979) from the 216-B-2-1 Ditch to the 216-B-3 Pond, although much of the waste infiltrated through the ditch bottom (Stenner et al. 1988). The head of the ditch is about 1,980 m (6,500 ft) northeast of the 221-B Building.

Waste streams include 221-B Building steam condensate, process cooling water and chemical sewer waste; 284-E Powerhouse water; 241-CR Vault cooling water; 242-A Evaporator cooling water; 202-A Building process waste; condenser condensate; air sampling vacuum pump seal cooling water, and chemical sewer and acid fractionator condensate; and 241-BY Tank Farm condenser cooling water (Stenner et al. 1988).

Unplanned Release UPR-200-E-34 affected this ditch. It occurred in June 1964 when a coil leak from the F-15 PUREX Tank released an estimated 10,000 Ci of short- and long-lived fission products (Meinhardt and Frostenson 1979). The contamination went through the 216-B-3-1 Ditch to the 216-B-3 Pond. Gable Mountain Pond was also affected. Remedial action was taken to kill the algae and precipitate the fission products. The 216-B-3-1 Ditch was backfilled and replaced by the 216-B-3-2 Ditch.

In 1971, 10-mil plastic sheets were placed over a new 10-cm (4-in.) layer of sand. The sheets were overlapped 1 m (2 ft) to provide an effective root barrier. The sheeting was then covered with 46 cm (18 in.) of sand and topped with 10 cm (4 in.) of gravel to prevent erosion by the wind. The entire ditch was treated in this fashion, except for the 30 m (100 ft) nearest the head of the ditch located at the western boundary of operable unit 200-BP-11. At the eastern end of the ditch, the treated area is about 30 m (100 ft) wide. This is where the 216-A-29 Ditch had intersected this ditch. This area experienced swampy conditions when both ditches were operational. The plastic barrier has been effective in limiting radioactive contaminated weed growth (Maxfield 1979). The stabilization work also covered the 216-B-3-2 Ditch location.

2.3.5.13 216-B-3-2 Ditch. The 216-B-3-2 Ditch is located south of, and replaced, the 216-B-3-1 Ditch. It is 1,128 m (3,700 ft) long, 4.6 m (15 ft) wide at ground level, and 1.2 to 2.4 m (4 to 8 ft) deep. Operational use of this ditch began in July 1964 and was terminated in September 1970 after it became contaminated with ^{90}Sr (UPR-200-E-138) in March 1970 (Maxfield 1979). Maximum dose rates at the head of the ditch, following the unplanned release measured 450 mR/h. The ditch was backfilled following the unplanned release (WHC 1991a).

The ditch carried the following waste to the 216-B-3 Pond system: 221-B Building steam condensate and process cooling water; 284-E Powerhouse water; 241-CR Vault cooling water; 242-A Evaporator cooling water; 202-A Building process waste; condenser water; air sampling vacuum pumps seal cooling water; chemical sewer waste; acid fractionator condensate; 241-BY Tank Farm condenser cooling water; and WESF cooling water (Stenner et al. 1988).

2.3.5.14 216-B-3-3 Ditch/UPR-200-E-51. The 216-B-3-3 Ditch began service in September 1970 and is currently active. It trends south of, and sub-parallel to the ditches that it replaced. The ditch is 1,128 m (3,700 ft) long, 6 m (20 ft) wide at ground level, and 1.8 m (6 ft) deep. One unplanned release (UPR-200-E-51) is associated with this ditch. It occurred in May 1977 when 15 kg of cadmium nitrate was released from tank TK-324 in the 202-A Building in the PUREX Plant Aggregate Area. The contamination passed through the 216-B-3-3 Ditch and a portion of it reached the 216-B-3 Pond. Currently, the ditch is on an annual survey schedule.

2.3.5.15 216-B-20 Trench. From 1952 to 1958, liquid wastes containing uranium and fission products resulting from the bismuth phosphate separations process were removed from underground storage tanks for uranium recovery. After the uranium was recovered, the cesium and strontium content of the effluent stream was reduced by precipitate scavenging. The resultant supernatant liquor was released to the ground in the BC Cribs and Trenches. The 216-B-20 through 216-B-34 Trenches, as well as the 216-B-52, -53A, -53B, -54, and -58 Trenches are located in the BC Controlled Area, south of the southern entrance to the 200 East Area.

The 216-B-20 through 216-B-22 Trenches are parallel and trend northeast. The 216-B-20 Trench is 150 m (500 ft) long, 3 m (10 ft) wide, has a design depth of 4 m (12 ft), and was divided into 19 m (62.5 ft) sections by 1.2 m (4 ft) high earth dams. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

During August 1956, the 216-B-20 Trench received 4,680,000 L (1,240,000 gal) of scavenged tributyl phosphate waste, which is high salt and neutral/basic. The liquids disposed to this trench contained ferrocyanide, nitrate, phosphate, sodium, and sulfate based conpounds. Radionuclides contained in the waste stream at the time of discharge included 4.4 Ci of ^{60}Co, 1,500 Ci of ^{137}Cs, 790 Ci of ^{90}Sr, 10,000 Ci of ^{106}Ru, 1.3 g of plutonium and 350 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting each trench to the permanant underground line (see Figure 2-9). After the piping was removed, it was disposed in a shallow, 1 to 1.2 m (3 to 4 ft), trench located between cribs 216-B-29 and 216-B-53A. The deactivated trench was then backfilled with excavated material which was stored adjacent to it. In 1969, the trenches were covered with 15 cm (6 in.) of gravel (DOE/RL 1991a).

2.3.5.16 216-B-21 Trench. The 216-B-21 Trench is located on the west side of the 216-B-20 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, has a design depth of 4 m (12 ft), and was divided into 19 m (62.5 ft) sections by 1.2 m (4 ft) high earth dams. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between September and October 1956, the 216-B-21 Trench received 4,670,000 L (1,230,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 6.5 Ci of ^{60}Co, 370 Ci of ^{137}Cs, 740 Ci of ^{90}Sr, 15,000 Ci of ^{106}Ru, 10 g of plutonium, and 680 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.17 216-B-22 Trench. The 216-B-22 Trench is located on the west side of the 216-B-21 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, has a design depth of 4 m (12 ft), and was divided into 19 m (62.5 ft) sections by 1.2 m (4 ft) high earth dams. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

During October 1956, the 216-B-22 Trench received 4,740,000 L (1,250,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 13 Ci of ^{60}Co, 45 Ci of ^{137}Cs, 410 Ci of ^{90}Sr, 30,000 Ci of ^{106}Ru, 2.6 g of plutonium, and 420 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.18 216-B-23 Trench. The 216-B-23 through 216-B-28 Trenches are in a east-west trending group south of the 216-B-20 through 216-B-22 group. The 216-B-23 Trench is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (10 ft) deep, and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft) high earth dams (DOE/RL 1991a). Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit. The side slopes are 1.5:1.

During October 1956, the 216-B-23 Trench received 4,520,000 L (1,190,000 gal) of scavenged tributyl phosphate waste. Radionuclides contained in the waste stream at the time of discharge included 6.7 Ci of ^{60}Co, 110 Ci of ^{137}Cs, 150 Ci of ^{90}Sr, 15,000 Ci of ^{106}Ru, 1.8 g of plutonium, and 160 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting each trench to the permanent underground line (see Figure 2-9). After the piping was removed, it was disposed in a shallow, 1 to 1.2 m (3 to 4 ft), trench located between cribs 216-B-29 and 216-B-53A. The deactivated trench was then backfilled with excavated material which was stored adjacent to it. In 1969, the trenches were covered with 15 cm (6 in.) of gravel (DOE/RL 1991a).

2.3.5.19 216-B-24 Trench. The 216-B-24 Trench is immediately south of the 216-B-23 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (10 ft) deep (Maxfield 1979), and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft) high earth dams (DOE/RL 1991a). The side slopes are 1.5:1. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between October and November 1956, the 216-B-24 Trench received 4,700,000 L (1,200,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 10 Ci of ^{60}Co, 130 Ci of ^{137}Cs, 180 Ci of ^{90}Sr, 23,000 Ci of ^{106}Ru, 7.7 g of plutonium, and 250 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The collapse potential appears to be small because the weakness of the cover design probably caused most of it to collapse during backfilling.

2.3.5.20 216-B-25 Trench. The 216-B-25 Trench is immediately south of the 216-B-24 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (10 ft) deep, and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft.) high earth dams (DOE/RL 1991a). The side slopes are 1.5:1. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between November and December 1956, the 216-B-25 Trench It received 3,760,000 L (990,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 6.9 Ci of ^{60}Co, 56 Ci of ^{137}Cs, 210 Ci of ^{90}Sr, 16,000 Ci of ^{106}Ru, 2 g of plutonium, and 150 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.21 216-B-26 Trench. The 216-B-26 Trench is immediately south of the 216-B-25 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (10 ft) deep, and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft) high earth dams (DOE/RL 1991a). The side slopes are 1.5:1. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between December 1956 and February 1957, the 216-B-26 Trench received 5,880,000 L (1,550,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 11 Ci of ^{60}Co, 950 Ci of ^{137}Cs, 1,100 Ci of ^{90}Sr, 24,000 Ci of ^{106}Ru, 2.5 g of plutonium, and 590 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The collapse potential appears to be small because the weakness of the cover design probably caused most of it to collapse during backfilling.

2.3.5.22 216-B-27 Trench. The 216-B-27 Trench is immediately south of the 216-B-26 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (ten ft) deep, and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft) high earth dams (DOE/RL 1991a).

The side slopes are 1.5:1. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between February and April 1957, the 216-B-27 Trench received 4,420,000 L (1,170,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 7.6 Ci of ^{60}Co, 34 Ci of ^{137}Cs, 600 Ci of ^{90}Sr, 17,000 Ci of ^{106}Ru, 0.7 g of plutonium, and 340 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.23 216-B-28 Trench/UN-200-E-83. The 216-B-28 Trench is immediately south of the 216-B-27 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, approximately 3 m (10 ft) deep, and divided into 19 m (62.5 ft) long sections by 1.2 m (4 ft) high earth dams (DOE/RL 1991a). The side slopes are 1.5:1. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between April and June 1957, the 216-B-28 Trench received 5,050,000 L (1,330,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 2.3 Ci of ^{60}Co, 23 Ci of ^{137}Cs, 110 Ci of ^{90}Sr, 5,200 Ci of ^{106}Ru, 5.6 g of plutonium, and 300 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The collapse potential appears to be small because the weakness of the cover design probably caused most of it to collapse during backfilling.

In May 1958 radioactive rabbit and coyote feces were found scattered over the ground surface of the desert as far as 2.5 miles south, east, and west of the BC Cribs and Trenches. It is supposed that a badger or some other animal burrowed into the 216-B-28 Trench and exposed a radioactive salt layer. Rabbits and coyotes ingested the contaminated salts and defecated over an approximately 4 square mile area of undisturbed land covered by sagebrush and cheat grass. Surface contamination is spread throughout. This contaminated area, known as the BC Controlled Area, was given the unplanned release number UN-200-E-83.

2.3.5.24 216-B-29 Trench. The 216-B-29 through 216-B-34 Trenches were constructed in an east-west trending group northwest of the 216-B-23 through 216-B-28 group. The 216-B-29 Trench is 150 m (500 ft) long, 3 m (10 ft) wide, 3 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit. These trenches also have wooden covers, and are considered a collapse hazard (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The 216-B-29 Trench, the northernmost of the group, received 4,840,000 L (1,280,000 gal) of waste containing ferrocyanide, nitrate, phosphate, sodium, and sulfate based compounds during June and July 1957. Radionuclides contained in the waste stream at the time of discharge included 7.1 Ci of ^{60}Co, 59 Ci of ^{137}Cs, 190 Ci of ^{90}Sr, 16,000 Ci of ^{106}Ru, 1.1 g of plutonium, and 340 kg of uranium (Maxfield 1979).

2.3.5.25 216-B-30 Trench. The 216-B-30 Trench is south of the 216-B-29 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, 3 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

During July 1957, the 216-B-30 Trench received 4,780,000 L (1,260,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 1.7 Ci of ^{60}Co, 3,400 Ci of ^{137}Cs, 600 Ci of ^{90}Sr, 3,900 Ci of ^{106}Ru, 2.1 g of plutonium, and 88 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.26 216-B-31 Trench. The 216-B-31 Trench is south of the 216-B-30 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, 3 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between July and August 1957, the 216-B-31 Trench received 4,740,000 L (1,250,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 2.7 Ci of ^{60}Co, 28 Ci of ^{137}Cs, 210 Ci of ^{90}Sr, 6,100 Ci of ^{106}Ru, 5.2 g of plutonium, and 120 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.27 216-B-32 Trench. The 216-B-32 Trench is south of the 216-B-31 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, 5 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between August and September 1957, the 216-B-32 Trench received 4,770,000 L (1,260,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 1.7 Ci of ^{60}Co, 130 Ci of ^{137}Cs, 260 Ci of ^{90}Sr, 3,800 Ci of ^{106}Ru, 2.6 g of plutonium, and 11 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.28 216-B-33 Trench. The 216-B-33 Trench is south of the 216-B-32 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, 3 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

Between September and October 1957, the 216-B-33 Trench received 4,740,000 L (1,250,000 gal) of scavenged tributyl phosphate waste, containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides disposed to the trench include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium. Radionuclides contained in the waste stream at the time of discharge included 1.4 Ci of ^{60}Co, 270 Ci of ^{137}Cs, 41 Ci of ^{90}Sr, 3,200 Ci of ^{106}Ru, 12 g of plutonium, and 20 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.29 216-B-34 Trench. The 216-B-34 Trench is south of the 216-B-33 Trench. It is 150 m (500 ft) long, 3 m (10 ft) wide, 3 m (10 ft) deep, and divided into two sections by a 1.5 m (5 ft) high and 1.5 m (5 ft) wide earthen dam at the center. Eight sections of dispersion pipe were placed along the side slope to the bottom of the unit.

During October 1957, the 216-B-34 Trench received 4,870,000 L (1,290,000 gal) of scavenged tributyl phosphate waste containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 0.6 Ci of ^{60}Co, 17 Ci of ^{137}Cs, 41 Ci of ^{90}Sr, 1,400 Ci of ^{106}Ru, 5.7 g of plutonium, and 85 kg of uranium (Maxfield 1979). This trench was constructed with a weak wooden cover approximately 0.6 m (2 ft) above the trench bottom. A survey identified collapse potential for this trench (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

2.3.5.30 216-B-35 Trench. The 216-B-35 through 216-B-42 Trenches are inactive waste management units located about 60 m (200 ft) due west of the 241-BX Tank Farm. They are 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). These trenches received first-cycle high salt, neutral/basic supernatant waste from the 221-B Building (Maxfield 1979).

The 216-B-35 Trench is the southernmost of the group. Between February and March 1954, it received 1,060,000 L (280,000 gal) of first-cycle supernatant waste containing fluoride, nitrate, nitrite, phosphate, sodium acuminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 430 Ci of ^{137}Cs, 240 Ci of ^{90}Sr, 230 Ci of ^{106}Ru, 1.2 g of plutonium, and 17 kg of uranium (Maxfield 1979).

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting it to the permanent underground line (see Figure 2-9). The deactivated trench was then backfilled to grade. Stabilization of the trench site was completed on October 19, 1982, and consisted of the addition of 1 m (2 ft) of topsoil treated with 2,4-d amine and seeded with thickspike, crested, and Siberian wheatgrasses (WHC 1991a).

2.3.5.31 216-B-36 Trench. The 216-B-36 Trench is north of the 216-B-35 Trench. It is 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active from March to April 1954, received 1,940,000 L (510,000 gal) of high salt, neutral/basic first-cycle supernatant waste from the 221-B (Maxfield 1979). Compounds in the liquid disposed to this site fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 770 Ci of ^{137}Cs, 490 Ci of ^{90}Sr, 470 Ci of ^{106}Ru, 0.8 g of plutonium, and 16 kg of uranium (Maxfield 1979).

2.3.5.32 216-B-37 Trench. The 216-B-37 Trench is north of the 216-B-36 Trench. It received first-cycle bottoms from the 242-B Waste Evaporator (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active during August 1954, received 4,320,000 L (1,140,000 gal) of first-cycle bottoms waste from the 242-B Waste Evaporator (Maxfield 1979). The waste is high salt and neutral/basic. Compounds in the liquid disposed to this site include fluoride, nitrate, nitrite, phosphate, sodium, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 1 Ci of ^{60}Co, 3,100 Ci of ^{137}Cs, 16 Ci of ^{90}Sr, 500 Ci of ^{106}Ru, 2 g of plutonium, and 3.6 kg of uranium (Maxfield 1979).

2.3.5.33 216-B-38 Trench. The 216-B-38 Trench is north of the 216-B-37 Trench. It is 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active during July 1954, received 1,430,000 L (380,000 gal) of high salt, neutral/basic first-cycle supernatant waste from the 221-B Building (Maxfield 1979). Compounds in the liquid disposed to this site fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 510 Ci of ^{137}Cs, 1,900 Ci of ^{90}Sr, 560 Ci of ^{106}Ru, 1.2 g of plutonium, and 42 kg of uranium (Maxfield 1979).

2.3.5.34 216-B-39 Trench. The 216-B-39 Trench is north of the 216-B-38 Trench. It is 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active from December 1953 to November 1954, received 1,470,000 L (390,000 gal) of high salt, neutral/basic first-cycle supernatant waste from the 221-B Building (Maxfield 1979). Compounds in the liquid disposed to this site fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 450 Ci of ^{137}Cs, 23 Ci of ^{90}Sr, 65 Ci of ^{106}Ru, 1.5 g of plutonium, and 5.8 kg of uranium (Maxfield 1979).

2.3.5.35 216-B-40 Trench. The 216-B-40 Trench is north of the 216-B-39 Trench. It is 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active from April to July 1954, received 1,640,000 L (430,000 gal) of high salt, neutral/basic first-cycle supernatant waste from the 221-B Building (Maxfield 1979). Compounds in the liquid disposed to this site include fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 350 Ci of ^{137}Cs, 280 Ci of ^{90}Sr, 240 Ci of ^{106}Ru, 1 g of plutonium, and 35 kg of uranium (Maxfield 1979).

2.3.5.36 216-B-41 Trench. The 216-B-41 Trench is north of the 216-B-39 Trench. It is 77 m (252 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979). The unit was deactivated by removing the aboveground piping when specific retention was reached (Maxfield 1979).

The trench, active during November 1954, received 1,440,000 L (380,000 gal) of high salt, neutral/basic first-cycle supernatant waste from the 221-B Building (Maxfield 1979). Compounds in the liquid disposed to this site include fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate based compounds. Radionuclides contained in the waste stream at the time of discharge included 890 Ci of ^{137}Cs, 47 Ci of ^{90}Sr, 130 Ci of ^{106}Ru, 0.3 g of plutonium, and 7.5 kg of uranium (Maxfield 1979).

2.3.5.37 216-B-42 Trench. The 216-B-42 Trench is west of the 216-B-35 Trench. The 216-B-42 Trench is 76 m (252 feet) long, 3 m (10 feet) wide, and 3 m (10 feet) deep. The sides of the excavation have a slope of 1.5:1.

The trench, active from January to February 1955, received 1,500,000 L (396,200 gal) of scavenged tributyl phosphate supernatant waste from the 221-U Building. The waste contains a high salt content and is neutral to basic in pH. Compounds contained in the waste include ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 10 Ci of ^{60}Co, 96 Ci of ^{137}Cs, 1,100 Ci of ^{90}Sr, 1,500 Ci of ^{106}Ru, 10 g of plutonium, and 680 kg of uranium (Maxfield 1979).

2.3.5.38 216-B-52 Trench. The 216-B-52 Trench is parallel to and immediately north of the 216-B-23 through -28 group of trenches in the BC Controlled area. It is 180 m (580 ft) long, 3 m (10 ft) wide, 2.4 m (8 ft) deep, and divided in half by earthen dams and has a wood cover. The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The trench, active from December 1957 to January 1958, received 8,530,000 L (2,250,000 gal) of scavenged tributyl phosphate waste from the tributyl phosphate recovery process in the 221-U Building (Maxfield 1979), containing ferrocyanide, nitrate, phosphate, sodium, and sulfate. Radionuclides contained in the waste stream at the time of discharge included 4.5 Ci of ^{60}Co, 340 Ci of ^{137}Cs, 11 Ci of ^{90}Sr, 8,600 Ci of ^{106}Ru, 19 g of plutonium, and 30 kg of uranium (Maxfield 1979).

2.3.5.39 216-B-53A Trench. The 216-B-53A, -53B, -54, and -58 Trenches were operated in the mid 1960's. They are located in the BC Controlled Area. The 216-B-53A Trench is 18 m (60 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep. It is divided in half by an earthen dam across the center of the trench. A "sisalkraft" cover (a wooden frame consisting of 1 x 2's and 2 x 4's covered with sisalkraft tar paper) was placed over each trench while in operation. The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The 216-B-53A Trench received 549,000 L (145,000 gal) of liquid waste from the Plutonium Recycle Test Reactor in the 300 Area between October and November 1965. The Hazardous Chemical Inventory in the WIDS database only indicates 1 kg (2 lb) of nitrates were contained in the waste streams disposed to this trench. Radionuclides contained in the waste stream at the time of discharge included 5 Ci of ^{106}Ru, 100 g of plutonium, and 23 kg of uranium (Maxfield 1979).

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting it to the permanent underground line (see Figure 2-9). The deactivated trench was then backfilled to grade and stabilized by adding 0.6 m (2 ft) of topsoil which was seeded with thickspike, Siberian, and crested wheatgrass.

2.3.5.40 216-B-53B Trench. The 216-B-53B Trench is located in the BC Controlled area, south of the 216-B-53A Trench. It trends northeast, and is very close to the southeast corner of the 216-B-53A Trench. The 216-B-53B Trench is 45 m (150 ft) long, 2.4 m (8 ft) wide, and 3 m (10 ft) deep. It is divided in half by an earthen dam across the center of the trench. A "sisalkraft" cover (a wooden frame consisting of 1 x 2's and 2 x 4's covered with sisalkraft roofing paper) was placed over each trench while in operation. The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The 216-B-53B Trench received 15,100 L (3,990 gal) of liquid waste from the Plutonium Recycle Test Reactor in the 300 Area between September 1962 and March 1963. The Hazardous Chemical Inventory in the WIDS database does not show a list of inorganics, but it is presumed that the waste stream was similar to that which entered 216-B-53A. Radionuclides contained in the waste stream at the time of discharge included 1 Ci of ^{60}Co, 7 Ci of ^{137}Cs, 10 Ci of ^{90}Sr, 4 Ci of ^{106}Ru, 5 g of plutonium, and 9.1 kg of uranium (Maxfield 1979).

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting it to the permanent underground line (see Figure 2-9). The deactivated trench was then backfilled to grade and stabilized by adding 0.6 m (2 ft) of topsoil which was seeded with thickspike, Siberian, and crested wheatgrass.

2.3.5.41 216-B-54 Trench. The 216-B-54 Trench is located in the BC Controlled area, south of the 216-B-53A and -53B Trenches. It trends east-west. The 216-B-54 Trench is 60 m (200 ft) long, 3 m (10 ft) wide, and 2.4 m (8 ft) deep (Maxfield 1979). It is divided in half by an earthen dam across the center of the trench. A "sisalkraft" cover (a wooden frame consisting of 1 x 2's and 2 x 4's covered with sisalkraft roofing paper) was placed over each trench while in operation. The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The 216-B-54 Trench received 999,000 L (264,000 gal) of liquid waste from the Plutonium Recycle Test Reactor in the 300 Area between March 1963 and October 1965. The Hazardous Chemical Inventory in the WIDS database indicates that only 100 kg (220 lb) of nitrates were contained in the waste stream disposed to this trench. Radionuclides contained in the waste stream at the time of discharge included 10 Ci of ^{106}Ru, 5 g of plutonium, and 9.1 kg of uranium (Maxfield 1979).

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting it to the permanent underground line (see Figure 2-9). The deactivated trench was then backfilled to grade and stabilized by adding 0.6 m (2 ft) of topsoil which was seeded with thickspike, Siberian, and crested wheatgrass.

2.3.5.42 216-B-58 Trench. The 216-B-58 Trench is located in the BC Controlled area, south of the 216-B-54 and -53B Trenches. It trends east-west. The 216-B-58 Trench is 60 m (200 ft) long, 3 m (10 ft) wide, and 2.4 m (8 ft) deep (Maxfield 1979). Earthen dams divide the 216-B-58 Trench into 8-m (25-ft) sections, each of which was covered by a "sisalkraft" cover (a wooden frame consisting of 1 x 2's and 2 x 4's covered with sisalkraft roofing paper) while in operation. A corrugated 122 cm (48 in.) STL pipe is placed along the bottom. The trench also contains a wooden cover that creates a collapse potential (Ortiz 1974). The low height of the structure, the small size of the wood used, and the age, combined with its probable collapse during backfilling, suggests that the current collapse potential is minimal.

The 216-B-58 Trench received 999,000 L (264,000 gal) of liquid waste from the Plutonium Recycle Test Reactor in the 300 Area between March 1963 and October 1965.

The Hazardous Chemical Inventory in the WIDS database indicates that only 100 kg (220 lb) of nitrates were contained in the waste stream disposed to this trench. Radionuclides contained in the waste stream at the time of discharge included 2.4 Ci of ^{60}Co, 7.7 Ci of ^{137}Cs, 10 Ci of ^{90}Sr, 7 Ci of ^{106}Ru, 6.7 g of plutonium, and 9.1 kg of uranium (Maxfield 1979).

When the specific retention capacity of the trench was reached, it was deactivated by disconnecting the short section of above ground piping connecting it to the permanent underground line (see Figure 2-9). The deactivated trench was then backfilled to grade and stabilized by adding 0.6 m (2 ft) of topsoil which was seeded with thickspike, Siberian, and crested wheatgrass.

2.3.5.43 216-B-63 Trench. The 216-B-63 Trench, a RCRA facility, is located northeast of the 221-B Building and originates approximately 366 m (1,200 ft) east of Baltimore Avenue. It is an open, unlined earthen trench, approximately 1.2 m (4 ft) wide at the bottom, 427 m (1,400 ft) long, and 3 m (10 ft) deep. The trench, closed at one end, did not convey effluent to other facilities. The side slope is 1.5:1. There is a 5.1 cm (2 in.) rockfill for the first 3.1 m (10 ft) of the trench and there is a 40.6 cm (16 in.) CSTL SCH 10 inlet pipe about 1.5 m (5 ft) long that enters the trench 1 m (3 ft) below grade.

The 216-B-63 Trench received effluents from floor drains and chemical sewers in the 221-B, 225-B, and 271-B Buildings via the 207-B Retention Basin (WHC 1991a). It was also to be used as an emergency discharge point for B Plant cooling water, but has never received that stream. Average discharge into the 216-B-63 Trench ranged from 378 to 1,408,000 L/day (100,000 to 400,000 gal/day) during normal operations. Routine discharge to the trench was discontinued in February 1992.

The only documented hazardous effluent discharged to the trench consisted of demineralizer recharge effluent and compressor cooling water from the 221-B Building. From 1970 to 1985, the demineralizer recharge effluent contained aqueous H_2SO_4 and NaOH solutions; after 1985, the cation column effluent was treated with sodium carbonate and the anion column effluent was treated with monosodium phosphate to maintain a combined pH between 4 and 10. As of 1987, the waste discharged to 216-B-63 was no longer considered to be "Dangerous Waste" under WAC 173-303. According to a study done by Meinhardt and Frostensen (1979), radiological discharges to the trench were relatively low with a total beta discharge of 8.7 Ci, and approximately 7.6 kg (16.7 lb) of uranium.

In August 1970, the 216-B-63 Trench was dredged (after UPR-200-E-138). The dredgings, reading approximately 3,000 ct/min of beta/gamma activity, were buried in the 218-E-12B Burial Ground.

2.3.6 Septic Tanks and Associated Drain Fields

Septic tanks and associated drain fields are designed to accept sanitary sewer effluent from the buildings in the B Plant Aggregate Area. The locations of the septic tanks and drain fields are shown on Figure 2-8.

2.3.6.1 2607-EB Septic Tank and Tile Field. The 2607-EB Septic Tank and Tile Field was activated in 1951 and is currently generating about 0.02 m^3 of sanitary wastewater and sewage per day. The waste management unit is listed as nonhazardous and nonradioactive. Adjacent to the septic tank is a drain field composed of vitrified clay pipe, concrete pipe, or drain tile forming the main line and laterals from the tank.

2.3.6.2 2607-EH Septic Tank and Drain Field. Data in the WIDS files show the 2607-EH Septic Tank was built in 1983 and remains in use today. The unit includes a drain field receiving about 1.36 m^3 of sanitary wastewater and sewage per day. It is believed to be located on the west side of Baltimore Avenue adjacent to the east side of the 2101-M Building.

2.3.6.3 2607-EK Septic Tank and Drain Field. The 2607-EK Septic Tank and drain field are located about 60 m (200 ft) east of Baltimore Avenue and 200 m (700 ft) south of the 2607-E8 Septic Tank. The tank and drain field were constructed in 1980. The tank receives about 24,200 L (6,395 gal) (64% of capacity) of waste per day. The septic tank is believed to have a 57,000 to 72,000 L (15,000 to 19,000 gal) capacity. The drain field is about 2,200 ft^2 and is operating at about 387% of its design capacity.

2.3.6.4 2607-EM Septic Tank and Drain Field. The 2607-EM Septic Tank and drain field are located southeast of the Akron Avenue and 4th Street intersection. The system was built in 1984 and receives waste from the 2721-E Building. The septic tank receives approximately 6,380 L (1,685 gal) of waste per day which is estimated to be 50% of the design capacity. The tank has a maximum capacity of 20,000 L (5,000 gal). The associated drain field is 1,320 ft^2 and is operating at about 170% of its design capacity.

2.3.6.5 2607-EN Septic Tank and Drain Field. The 2607-EN Septic Tank is not identified in the Tri-Party Agreement. It was put into service sometime prior to 1980. The tank is situated about 30 m (100 ft) south of the 2727-E Building. The 2607-EN Septic Tank has a 9,500 L (2,500 gal) capacity and receives an estimated 2,060 L/day (545 gal/day). The waste drains to a 360 ft^2 drain field. The tank, at this input level, is at 32% capacity, while the drain field is running at 200% of capacity.

2.3.6.6 2607-EO Septic Tank and Drain Field. The 2607-EO Septic Tank is located about 46 m (150 ft) west of the 2711-E Building. This tank is not included in the Tri-Party

Agreement. The tank holds 9,500 L (2,500 gal) and has 2,120 L (560 gal) of daily input. It discharges to a 780 ft^2 drain field. The tank is operating at 33% of capacity and the drain field is running at 95% capacity.

2.3.6.7 2607-EP Septic Tank and Drain Field. The 2607-EP Septic Tank and Drain Field were constructed in 1984. The septic tank is adjacent to the northeast corner of building 2721-EA. The tank receives about 1,875 L (495 gal) of waste per day, approximately 49% of its designed capacity. The drain field is operating at about 131% of its capacity.

2.3.6.8 2607-EQ Septic Tank and Drain Field. The 2607-EQ Septic Tank is located approximately 46 m (150 ft) southeast of the Ames Avenue and 2nd Street intersection. This system was built in 1985 and consists of a 40,000 L (10,000 gal) septic tank and a 4,644 ft^2 drain field. Approximately 10,500 L (2,770 gal) of waste are discharged to the tank per day, about 41% of its design capacity. The drain field is operating at an estimated 79% capacity.

2.3.6.9 2607-ER Septic Tank. Data contained in the WIDS database lists the 2607-ER Septic Tank's location as 150 m (500 ft) southeast of the Akron Avenue and 4th Street intersection between the 2607-EP and 2607-EM Septic Tanks. The septic tank is actually located southwest of the Akron Avenue and the 4th Street intersection where Baltimore Avenue is intersected by railroad tracks. The 2607-ER Septic Tank has an estimated 4,000 L (1,000 gal) capacity. Information pertaining to the system's design capacity and daily waste estimates were not contained in the WIDS files.

2.3.6.10 2607-E1 Septic Tank and Drain Field. The 2607-E1 Septic Tank is currently active. The drain field entered operation in 1970 (WHC 1991a). The 2607-E1 Septic Tank is located about 60 m (200 ft) northeast of the intersection of Baltimore Avenue and 4th Street and the drain field is north of the tank. The tank is constructed of reinforced concrete with 25-cm (10-in.) walls and floor and dimensions of 8 x 3.2 x 4 m (25 x 10.5 x 13 ft) deep. It is designed to serve 400 people with an average retention period of 24 hours (WHC 1991a). Estimated waste inflow is 21,555 L/day (5,695 gal/day) (42% of capacity), but it is expected that the input will increase to 29,837 L/day (7,883 gal/day).

The drain field is constructed of 10-cm (4-in.) diameter vitrified clay pipe, concrete pipe, or drain tile with a minimum of 8 linear feet per capita. The laterals are spaced 2.4 m (8 ft) apart and are open jointed (WHC 1991a). The drain field covers 8,376 ft^2 and is currently operating at 90% capacity.

2.3.6.11 2607-E2 Septic Tank and Drain Field. The 2607-E2 Septic Tank is not in the Tri-Party Agreement, but is located in the 200-SS-1 Operable Unit. It is about 60 m (200 ft) northeast of the intersection of Baltimore Avenue and 1st Street. It has a volume of 25,000 L (6,620 gal) and has a daily input of 2,380 L (630 gal). There are two drain fields associated with this tank, the original field having an area of 913 m^2 (9,831 ft^2) and a new drain field of 2,300 m^2 (25,000 ft^2). There is no indication in the literature as to whether they are both active or not.

2.3.6.12 2607-E3 Septic Tank and Tile Field. The 2607-E3 Septic Tank is an active waste management unit located about 100 m (400 ft) north of the 221-B Building. The septic tank became operational in 1944 having a 292 person capacity and receiving about 14.4 m^3 of sanitary wastewater and sewage per day from the B Plant Aggregate Area facilities. The septic tank is 4.15 m (13.6) deep and is constructed of reinforced concrete. The tile field is comprised of 10 cm (4 in.) vitrified clay pipe and drain tile. The laterals are open jointed and are spaced 2.4 m (8 ft) apart. The septic tank and tile field contain no radionuclides or hazardous chemicals. It is listed in the nonhazardous/nonradioactive waste category (WHC 1991a). A WIDS General Summary Report indicates that mixed waste may have been introduced to the tile field. Information in the general summary report is sketchy and incomplete. The tile field associated with this septic tank is believed to be the same tile field south of the 218-E-4 Burial Ground.

2.3.6.13 2607-E4 Septic Tank and Tile Field. The 2607-E4 Septic Tank and Tile Field is an active waste management unit located 60 m (200 ft) northeast of the 221-B Building. The unit became operational in 1944 and currently receives about 0.24 m^3 of sanitary wastewater and sewage per day. The WIDS indicate the septic tank and tile field contain no radionuclides or hazardous chemicals and is in the nonhazardous/nonradioactive waste category (WHC 1991a). However, the septic tank and tile field are marked with underground radiation warning signs.

2.3.6.14 2607-E7B Septic Tank. The WIDS state that the active 2607-E7B Septic Tank has a 900-L (240-gal) capacity and is located immediately northwest of the intersection of Baltimore Avenue and 4th Street (Figure 2-8) (WHC 1991a).

2.3.6.15 2607-E8 Septic Tank and Drain Field. The 2607-E8 Septic Tank was built in 1978 and is presently operational. The tank includes a drain field and is located on the east side of Baltimore Avenue across from the 2101-M Pond, immediately north of the 2607-EK Septic Tank. Waste inflow is approximately 7,400 L/day (1,960 gal/day). The drain field consists of four lateral sets of tiles arranged in a herringbone pattern. The drain field covers 800 m^2 (9,000 ft^2) and is operating at about 29% of capacity.

2.3.6.16 2607-E9 Septic Tank and Drain Field. The 2607-E9 Septic Tank and Drain Field is located adjacent to the 207-B Retention Basin. Liquid wastes received by the unit are nonhazardous and nonradioactive. The 242-B Building is the waste source for the 2607-E9 Septic Tank. The area east of the 242-B Building, where the 2607-E9 Septic Tank and Drain Field are located, is barricaded with a light chain and surface contamination warning signs. Contaminated particulate releases from the 241-B Tank Farm are the most likely source for the surface contamination.

2.3.6.17 2607-E11 Septic Tank and Drain Field. This 2607-E11 Septic Tank is located 30 m (100 ft) southeast of the Dry Materials Receiving and Handling Facility. It is a 8,500 L (2,250 gal) tank that receives about 3,160 L/day (835 gal/day) of sanitary wastewater and sewage. There is a 118 m^2 (1,275 ft^2) drain field included in this site. The volume handled by this system is 55% of the tank's operational capacity and 87% of the drain field's capacity.

2.3.6.18 2607-GF Septic Tank. The WIDS states that the 2607-GF Septic Tank is north of the Dry Materials Receiving and Handling Facility and across the railroad tracks that run on the north of that facility. The tank is listed as active (WHC 1991a).

2.3.6.19 Unnumbered Septic Tanks. There are two new septic tanks located in the 200-SS-1 Operable Unit. One is adjacent to the 281-E-3 Burial Ground and one is about 215 m (700 ft) northwest of the intersection of Ames Avenue and 1st Street. Kaiser Engineering Hanford is responsible for their construction and maintenance. No information on their volume or discharge was found in the literature.

2.3.7 Transfer Facilities, Diversion Boxes, and Pipelines

Transfer facilities connect the major processing facilities with each other and with the various waste disposal and storage facilities. Diversion boxes are concrete boxes with transfer lines leading into both sides. Jumpers in the box allow different lines to be connected to change the routing of wastes. Pipelines connect the waste generating facilities with the waste management units. The lines are mainly 7.6 cm (3 in.) diameter stainless steel pipes with welded joints and may either be enclosed in below grade, steel-reinforced concrete, or encased within a larger diameter steel pipe. Only pipelines that are suspected to have leaked are discussed in this AAMSR. A leak in a pipeline may be due to the segmented nature of its fabrication. Pipelines such as the Purex Cooling Water Line and the segment connecting the 216-B-2 Ditches to the 216-B-3 Ditches are likely candidates for leaking and would be more likely to warrant test pit examination than would others. Locations of the transfer facilities, diversion boxes, and pipelines are shown on Figure 2-9.

2.3.7.1 241-B-151 Diversion Box/UPR-200-E-4, UPR-200-E-73. The 241-B-151 Diversion Box is an underground structure located approximately 70 m (225 ft) south of the 241-B Tank Farm. It is made of reinforced concrete and is 6 m (20 ft) long, 3 m (9 ft) wide, and 4.6 m (15 ft) high. It interconnects the 241-B-152 and 241-B-153 Diversion Boxes and the

241-B and 241-BX Tank Farms. It transferred waste solutions from processing and decontamination operations to the 241-B and 241-BX Tank Farms.

It was in service from 1945 to 1984, and is now isolated and weather covered. Radionuclide inventories are not available; however, historical records indicate that the concrete structure is potentially contaminated with high levels of alpha, beta, and gamma emitters.

Approximately 10 Ci of fission products were transported to the soil surrounding the 241-B-153 Diversion Box as the result of leakage from the unit in the fall of 1951. Most of the contaminated soil was removed and transported to a burial ground. The remaining contamination was covered with about 0.3 m (1 ft) of clean soil (WHC 1991a). This unplanned release is designated UPR-200-E-4.

Between late 1951 and 1952, leaks and spills from work on the 241-B-151 Diversion Box contaminated soil surrounding the unit with approximately 10 Ci of fission products. Most of the contaminated soil was removed and the remaining contaminated areas are covered with about 0.3 m (1 ft) of clean soil. This unplanned release is documented as UPR-200-E-73.

2.3.7.2 241-B-152 Diversion Box/UPR-200-E-38, UPR-200-E-74. The 241-B-152 Diversion Box is an underground structure located approximately 60 m (200 ft) south of the 241-B Tank Farm and 12 m (40 ft) west of the 241-B-151 Diversion Box. It is made of reinforced concrete and is 8.5 m (28 ft) long, 3 m (9 ft) wide, and 4.6 m (15 ft) high. It interconnects the 241-B-151, 241-BX-153, and 241-B-154 Diversion Boxes and the 241-B Tank Farms. It transferred waste solutions from processing and decontamination operations to the 241-B and 241-BX Tank Farms.

It was in service from 1945 to 1984, and is now isolated and weather covered. Radionuclide inventories are not available; however, historical records indicate that the concrete structure is potentially contaminated with high levels of alpha, beta, and gamma emitters.

Unplanned release UPR-200-E-38 occurred on January 4, 1968 when a waste line leading to the 241-B-152 Diversion Box leaked 221-B Building cell drain waste that caused a small cave-in at the northeast corner of the box. The hole was backfilled, which reduced dose rates from 5 R/h to 20 mrem/h. A small area of the southern portion of the 241-B Tank Farm affected by aerially deposited contaminants was also covered with clean soil (Maxfield 1979).

Unplanned release UPR-200-E-74 occurred in the Spring of 1954 when work on the 241-B-152 Diversion Box contaminated about 5 m^2 (50 ft^2) of surface soil with approximately 1 Ci of mixed fission products. The contamination was removed and buried. Several inches of clean fill were placed on the contaminated area, rope barriers and radiation zone signs were installed (WHC 1991a).

2.3.7.3 241-B-153 Diversion Box/UPR-200-E-75, UPR-200-E-6. The 241-B-151 Diversion Box is an underground structure located approximately 25 m (75 ft) south of the 241-B Tank Farm and is almost directly north of the 241-B-151 Diversion Box. It is made of reinforced concrete and is 10 m (34 ft) long, 3 m (9 ft) wide, and 10 m (34 ft) high. It interconnects the 241-B-151 and 241-B-152 Diversion Boxes and the 241-B Tank Farm. It transferred waste solutions from processing and decontamination operations to the 241-B and 241-BX Tank Farms.

It was in service from 1945 to 1984, and is now isolated and weather covered. Radionuclide inventories are not available; however, records indicate that the concrete structure is potentially contaminated with high levels of alpha, beta, and gamma emitters.

In 1954 an unplanned release (UPR-200-E-6) resulted when waste containing about 1 Ci of fission products leaked from the 241-B-153 Diversion Box and contaminated the soil in the immediate vicinity. No decontamination information is available.

From 1954 to 1955 work on the 241-B-153 Diversion Box caused a general buildup to contamination around the unit. The contaminants contained about 1 Ci of fission products. The site was categorized as low-activity, covered with clean gravel, posted as a radiation zone, and documented as unplanned release UPR-200-E-75 (WHC 1991a).

2.3.7.4 241-B-154 Diversion Box. The 241-B-154 Diversion Box is located on the northeast corner of Baltimore Avenue and 7th Street. The diversion box, in service from 1945 to June 1984, was used to transfer various types of waste solutions from processing and decontamination operations to disposal sites. The 241-B-154 Diversion Box interconnects 241-B-151 and 241-B-152 Diversion Boxes and 221-B Building (WHC 1991a). It is 11 m (36 ft) long, 3 m (9 ft) wide and 5 m (17 ft) deep, and is made of 1 m (2 ft) thick concrete walls. Alpha, beta, and gamma contamination is estimated to be high (WHC 1991a).

2.3.7.5 241-B-252 Diversion Box. The unit transferred waste solutions from processing and decontamination operations between 1945 and June 1984. The unit is connected to the 241-BX-154 AND 241-B-152 diversion boxes and the 241-B and 241-BY Tank Farms (WHC 1991a).

2.3.7.6 241-BR-152 Diversion Box. The 241-BR-152 Diversion Box is located 8 m (25 ft) south of the 241-BX Tank Farm. The unit transferred waste solutions from processing and decontamination operations between 1948 and June 1984 and is associated with the 241-BX Tank Farm. It adjoins the 241-BXR-152 Diversion Box on the east. Encasements connect these diversion boxes with the 241-BXR and 241-BYR Diversion Boxes (WHC 1991a).

2.3.7.7 241-BX-153 Diversion Box. The 241-BX-153 Diversion Box is an inactive waste management unit located at the southern boundary in the 241-BX Tank Farm. The diversion box was in service from 1948 until June 1983 transferring waste solutions from processing and decontamination operations. Located adjacent to and below the diversion box is the 241-BX-302A Catch Tank that collects waste spilled in the box during transfers (WHC 1991a). Both units have been isolated and weather covered (Hanlon 1992). The 241-BX-153 Diversion Box interconnects the 241-B-152 and 241-B-155 Diversion Boxes and the 241-BX and 241-BY Tank Farms.

2.3.7.8 241-BX-154 Diversion Box. The 241-BX-154 Diversion Box is an inactive waste management unit located about 9 m (30 ft) south of the 221-B Building. The unit was in service from 1948 until July 1984. The diversion box interconnects the 241-B-252 and 241-BX-155 Diversion Boxes and the 221-B Building (WHC 1991a). Located adjacent to and below the diversion box is the 241-BX-302-B Catch Tank that collects waste spilled in the diversion box during transfers (Hanlon 1992). The 241-BX-154 Diversion Box has been isolated and stabilized by application of a weather proofing plasticizer (Hanlon 1992).

2.3.7.9 241-BX-155 Diversion Box/UPR 200-E-78. The 241-BX-155 Diversion Box is an inactive waste management unit and is located about 260 m (850 ft) northeast of B Plant between Atlanta and Baltimore Avenues. The unit was in service from 1948 until June 1984 transferring various types of waste solutions from processing and decontamination operations. The 241-BX-155 Diversion Box interconnects the 241-BX-154 Diversion box, 241-BX-Tank Farm, and 221-B Building (WHC 1991a). Located adjacent to and below the diversion box is the 241-BX-302C Catch Tank that collects waste spilled in the diversion box during transfers (WHC 1991a).

Unplanned release UPR-200-E-78 occurred when salt waste containing about 10 Ci of mixed fission products leaked from the diversion box during pressure testing of lines and jumpers contaminating about 200 ft^2 of the surrounding soil. The area was then covered with clean soil. The unplanned release site has been isolated and stabilized by application of a weather proofing plasticizer (Hanlon 1992).

2.3.7.10 241-BXR-151 Diversion Box. The 241-BXR-151 Diversion Box is an inactive waste management unit. The diversion box is located at the southern boundary in the 241-BX Tank Farm. The unit was in service from 1948 until June 1984 transferring waste solutions from processing and decontamination operations. The 241-BXR-151 Diversion Box is associated with the 241-BX Tank Farm where leak detection and air monitoring are performed continuously. The unit has been isolated and weather coated (WHC 1991a).

2.3.7.11 241-BXR-152 Diversion Box. The 241-BXR-152 Diversion Box is an inactive waste management unit. The diversion box is located at the southern boundary in the 241-BX Tank Farm. The unit was in service from 1948 until June 1984 transferring waste solutions from processing and decontamination operations. The 241-BXR-152 Diversion Box is associated with the 241-BX Tank Farm where leak detection and air monitoring are performed continuously. The unit has been isolated and weather coated (WHC 1991a).

2.3.7.12 241-BXR-153 Diversion Box. The 241-BXR-153 Diversion Box is an inactive waste management unit. The diversion box is located at the southern boundary in the 241-BX Tank Farm. The unit was in service from 1948 until June 1984 transferring waste solutions from processing and decontamination operations. The 241-BXR-153 Diversion Box is associated with the 241-BX Tank Farm where leak detection and air monitoring are performed continuously. The diversion box interconnected the 241-B-152 and 241-B-155 diversion boxes and the 241-BX and 241-BY Tank Farms. The unit has been isolated and weather coated (WHC 1991a).

2.3.7.13 241-BYR-152 Diversion Box. The 241-BYR-152 Diversion Box is located at the southern boundary within the 241-BX Tank Farm. The 241-BYR-152 Diversion Box is an inactive waste management unit that operated from 1950 until June 1984 transferring waste solutions from processing and decontamination operations. Leak detection and air monitoring are performed continuously within the tank farm in which it is located. The unit has been isolated and weather covered (WHC 1991a).

2.3.7.14 241-BYR-153 Diversion Box. The 241-BYR-153 Diversion Box is an inactive waste management unit associated with the 241-BY Tank Farm. The diversion box is located at the southern boundary in the 241-BX Tank Farm. The unit was in operation from 1950 until June 1984 transferring waste solutions from processing and decontamination operations. The unit has been isolated and weather covered. Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm (WHC 1991a).

2.3.7.15 241-BYR-154 Diversion Box. The 241-BYR-154 Diversion Box is an inactive waste management unit associated with the 241-BY Tank Farm. The diversion box is located at the southern boundary in the 241-BX Tank Farm. The unit was in operation from 1950 until June 1984 transferring waste solutions from processing and decontamination operations. The box has been isolated and weather covered. Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm (WHC 1991a).

2.3.7.16 241-ER-151 Diversion Box. The active 241-ER-151 Diversion Box is located 275 m (900 ft) southwest of the 221-B Building and is not associated with any tank farm. The diversion box receives cross-site process and decontamination waste from the 241-UX-154 Diversion Box via the 241-EW-151 Vent Station. Waste is also received from the 241-B Tank Farm via the 244-BX DCRT. The unit is a reinforced concrete structure with an attached enclosure for pipe housing. The main section is 14.3 m (43 ft) long by 3 m (10 ft) wide and 5.6 m (16.7 ft) deep. The pipe housing structure extends 10.5 m (31.5 ft) on the north side. The 241-ER-151 Diversion Box is associated with the 214-ER-311 Catch Tank. The area around the diversion box is surrounded by a 1.8 m (6 ft) high chain link fence.

2.3.7.17 241-ER-152 Diversion Box. The 241-ER-152 Diversion Box is an active waste management unit and is located approximately 55 m (180 ft) southeast of the 224-B Building. The diversion box was activated in 1945 and transfers various types of waste solutions from processing and decontamination operations (WHC 1991a). The walls are 0.3 m (1 ft) thick, and 5 m (15 ft) deep. Located adjacent to and at a lower elevation than the diversion box is the 241-ER-311 Catch Tank that collects waste spilled in the diversion box during transfers (Hanlon 1990).

2.3.7.18 242-B-151 Diversion Box. Located at the southern boundary of the 241-B Tank Farm, the 242-B-151 Diversion Box is an inactive waste management unit that operated from 1945 until June 1984 transferring waste solutions from processing and decontamination operations.

2.3.7.19 242-B Evaporator Building to 207-B Retention Basin Waste Line. Unplanned release UN-200-E-79 occurred when five leaks were detected in this line in June 1953. Up to 2,500 ct/min were detected at points of emission.

The line connecting the 242-B Evaporator Building and the 207-B Retention Basin is a 10-cm (4-in.) cast iron pipe. It exits the 242-B Evaporator Building on its west side, runs due south to a point approximately 20 m (70 ft) north of the retention basin, then cuts to the southwest and enters the basin on the west side.

2.3.7.20 221-B Building to 241-B-361 Settling Tank Waste Line. Unplanned release UN-200-E-7 occurred on November 30, 1954, when a leak developed in the waste line that connects the 221-B Building and 216-B-361 Settling Tank. The leak released cell wash water with 1.7 rem/h contamination (WHC 1991a).

The WIDS database states that the leak occurred in the line connecting the 216-B-361 Settling Tank, but occurred near the 216-B-9 Crib, which is northeast of the settling tank. The coordinates in WIDS correspond to a location on the waste line near the 216-B-9 Crib.

The settling tank was deactivated in 1947 (WHC 1991a) and the waste line to it was rerouted to 216-B-9, so the release is more correctly associated with the crib.

The line in question is V204, which emerges with seven other lines from the 241-B-154 Diversion box. Line V204 diverges from the unencased group north of the 216-B-361 Settling tank and runs northeast to the 216-B-9 Crib. The other lines continue north to 10th Street and then branch out to various diversion boxes. Line V204 is 9 cm (3.5 in.) diameter stainless steel, unencased, and enters the 216-B-9 Crib at invert elevation 205 m (671.7 ft), approximately 2 m (7 ft) below grade (WHC 1991a). Monitoring Well 299-E28-54 is very close to the coordinates of the leak.

2.3.7.21 221-B Building to 241-BX-154 Diversion Box Process Line. Two unplanned releases, in 1951 (UN-200-E-3) and 1972 (UN-200-E-85), are associated with this line. The pipe was not repaired after the 1951 leak because readings of 120 rem/h were detected with 46 cm (18 in.) of soil remaining over it and further excavation was deemed to be unwise (WHC 1991a).

The 241-BX-154 Diversion Box is approximately 6 m (20 ft) south of the 221-B Building, and is connected to it by two unencased lines V335 and V336. These lines are approximately 1.1 m (3.5 ft) below grade.

2.3.7.22 221-B Building to 241-B-110 Single-Shell Tank Pipeline. In January 1968, a leak developed in the line connecting Tank 9-2 in the 221-B Building and the 241-B-110 Tank. The coordinates correspond to a location along the three waste lines connecting the 241-B-152 and -153 Diversion Boxes.

2.3.7.23 BCS Crib Line. Two unplanned releases, in March and August 1972 are associated with the "BCS Crib Line." The line was sealed with a filter after the March leak (UN-200-E-103), and since the August leak (UN-200-E-44) occurred at the same coordinates, it probably resulted from failure of the repairs made after the March incident.

The line that produced these leaks is referred to as the "BCS Crib line", and the coordinates for these leaks give a location southeast of the 221-B Building, near 10th Street. The BCS Crib Line carried steam condensate from the B Plant Concentrator to the BCS Crib (216-B-55).

Lines V200 and V334 are located at the coordinates of the leak. These lines emerge from sections 10 and 9 of the 221-B Building, respectively, and end at the 241-B-154 Diversion Box. They enter the box at elevation 209 m (685.4 ft), approximately 4 m (12 ft) below grade. They connect to 8 cm (3 in.) diameter Hanford style nozzles at the box, and thus would be 9 cm (3.5 in.) stainless steel.

2.3.7.24 221-B Building Cooling Water Line. Unplanned releases UN-200-E-80 and UN-200-E-1 occurred in June 1946 and 1966, respectively. Metal waste leaked from the line in 1946 and contaminated the surrounding soil with approximately 10 Ci of fission products. The 1966 leak was approximately 24 m (80 ft) from the 1946 leak and apparently leaked a similar waste liquid as the 221-B Building was being restarted.

The line is 2904-E-1, a 61 cm (24 in.) diameter cast iron process sewer pipe. It begins on the south side of B Plant and runs east to the 241-B-154 Diversion Box, then turns north and proceeds to the 207-B Retention Basin. Approximately 15 m (50 ft) east of Baltimore Avenue it is converted to 61 cm (24 in.) VC pipe.

2.3.7.25 221-B Building to 224-B Concentration Facility Process Line. Unplanned release UN-200-E-87 occurred between 1945 and 1953. Subsurface plutonium contamination was found near buried process lines.

A 61 cm (24 in.) VCP encasement runs from the drain pit on the southwest corner of the 221-B Building to the southwest corner of the 224-B Concentration Facility. Thirteen lines run north from the encasement where it runs south of the 224-B Concentration Facility. The two easternmost of these lines bracket the location of the unplanned release, and are probably responsible for the seepage. Given the elevation of the bottom of the drain pit from which the encasement emerges, the lines are probably approximately 1 m (3 ft) below grade.

2.3.8 Basins

Retention basins are concrete-lined settling ponds that receive liquids before they overflow into ditches. Three basins are present in the B Plant Aggregate Area and their locations are shown on Figure 2-10.

2.3.8.1 207-B Retention Basin. Currently, the 207-B Retention Basin is an active retention basin for B Plant cooling water and chemical sewer effluent enroute to the 216-B-3 Pond. The 216-B-2 series ditches, which are parallel to the 216-B-63 Ditch, were initially used to convey liquid waste from the retention basin. The basin is located 600 m (2,000 ft) north east of the 221-B Building, immediately south of the 241-B Tank Farm.

The basin is concrete-lined, has a capacity of 3,800 m^3 (1,000,000 gal), and has dimensions of 75 m (246 ft) length, 37.5 m (123 ft) width, and 2 m (6.5 ft) depth. It is divided into two equal-sized sections. The structure was designed to take only low-level liquid wastes. The concrete walls of the unit have been contaminated over the years by a number of incidents involving radioactive water releases. In 1953, the walls were covered with a coat of tar to seal the residue contamination (Maxfield 1979).

On November 7, 1963, Unplanned Release UPR-200-E-32 contaminated the 207-B Retention Basin and 216-B-2-1 Ditch. The release is described in Section 2.3.5.10. Immediate clean-up actions were taken. Three hundred meters (1,000 ft) of the 216-B-2-1 Ditch was backfilled and replaced with a new ditch, presumably the 216-B-2-2 Ditch based on its start-up date. The retention basin walls were decontaminated by washing them down repeatedly with fire hoses, and then they were coated with an asphalt-oil emulsion. Fresh dirt was spread over the backfilled ditch and around the contaminated soils adjacent to the retention basin. Some tumbleweeds that had collected in the 207-B Retention Basin at the time of the unplanned release, were contaminated and removed for disposal. A 2.4-m (8-ft) chain link fence was erected around the basin later that same month to prevent tumbleweeds from getting into the basin (Maxfield 1979).

The 207-B Retention Basin is currently active and in use. Some spots with levels of contamination from 200 to 600 ct/min have been detected on the north side of the basin. Except for these spots perimeter surveys of the basin indicate only normal background levels of radiation (WHC 1991a).

2.3.8.2 216-B-59/59B Trench/Retention Basin. Centered approximately 230 m (750 ft) north of 7th Street the 216-B-59 Trench was designed to receive 221-B Building cooling water with radionuclide concentrations above those allowed for the existing ponds. The site was activated in December 1967 and only received a single delivery of approximately 477,000 L (126,000 gal) of waste. The trench was upgraded to a retention basin adding a hypalon liner and changing the identification number to 216-B-59B. The retention basin held diverted cooling water for subsequent reprocessing. It was later upgraded by replacing the hypalon liner with a concrete liner and cover. In addition, minor pumping and piping modifications were made. The retention basin is currently active and receives diverted wastes for reprocessing (WHC 1991a).

The retention basin is surrounded by a 2 m (6 ft) high chain link fence. Yellow contamination flags are adjacent to the western boundary. The concrete retention basin is about 9 m (30 ft) wide, 40 m (120 ft) long, and 3 m (10 ft) deep, and is situated in a 30 x 60 x 4.6 m (100 x 200 x 15 ft) deep excavation. The excavation has a gravel sub-base beneath the retention basin and the top of the basin is about 1.5 m (5 ft) below grade.

2.3.8.3 216-B-64 Retention Basin/UN-200-E-64. The 216-B-64 Retention Basin located 75 m (250 ft) west of the 221-B Building was constructed but has not been used with the exception of an initial test. It may, however, be used in future B Plant Processes. Built in 1974, the purpose of the basin was to receive steam condensate from the 221-B Building that exceeded release limits. The structure is surrounded by an 2.4 m (8 ft) chain link fence with surface contamination warnings. The surface contamination was discovered in October 1984 and was given the unplanned release number UN-200-E-64.

UN-200-E-64 was discovered on October 12, 1984, and is located on the west side of 216-B-64 Retention Basin. It predominantly consists of ^{137}Cs and ^{90}Sr contamination up to 100,000 ct/min. The original source of the release has not been determined, but an uncapped riser on a nearby pipeline encasement and activities at the nearby 270-E Condensate Neutralization Tank have been considered. The contamination has been spread by burrowing ants so that the zone is approximately 2 acres in size. Pesticides and stabilization methods are being investigated to control the spread (Schmidt et al. 1991).

2.3.8.4 Liquid Effluent Retention Facility. The Liquid Effluent Retention Facility (LERF) is a temporary effluent-storage area that is currently under construction immediately east of the 200 East Area and northwest of the 216-B-3 Pond. It will be used for the temporary storage of effluent prior to its treatment and disposal to a state approved disposal facility (Olascoaga 1991). The LERF will consist of four basins, each with two impermeable liners, and capable of containing up to approximately 24,600,000 L (6,500,000 gal) for a total capacity of 98,400,000 L (26,000,000 gal).

In addition, northeast of the LERF, two 3,785,000 L (1,000,000 gal) tanks constructed of 80 to 100 mil HDPE have been constructed to store and evaporate monitoring well purge water.

2.3.9 Burial Sites

Several solid waste burial sites are present in the B Plant Aggregate Area. These generally consisted of trenches that received contaminated material, then were backfilled and stabilized.

The locations of all the burial sites in the B Plant Aggregate are shown on Figure 2-11. A partial inventory of radionuclides disposed to the burial sites is summarized on Table 2-5.

2.3.9.1 200-E Powerhouse Ash Pit. The 200-E Powerhouse Ash Pit is an active waste management unit. The pit is located about 60 m (200 ft) south of 4th Street across from the entrance to the Dry Materials Receiving and Handling Facility. The ash pit received ash from the 200 East Area Powerhouse at a rate of about 9,480 yd^3/yr. The ash pit became active in 1943 and currently contains about 81,000 yd^3 of ash. The ash has been analyzed for EP Toxicity and no hazardous materials were found (WHC 1991a).

2.3.9.2 218-E-2 Burial Ground. The 218-E-2 Burial Ground is located around the railroad spur north of the 221-B Building. The burial ground consists of nine industrial waste trenches. The bottom widths are 3.3 m (11 ft), and the lengths range from 30 to 140 m (90 to 465 ft). The trenches received 0.0031 m^3 of mixed MFP/TRU dry wastes, which were backfilled. Radionuclides released to the trench include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium. This burial ground is also the location of the 218-E-9 Burial Ground, the above-ground storage site for fission product equipment.

An inspection on February 21, 1978 disclosed some degree of subsidence associated with each trench, and ground surface contamination on a number of tumbleweeds near the north end of the 218-E-9 Burial Ground. Extensive research was done in 1979 to determine the location of all burial trenches within the bounds of the 218-E-2, -5, -5A, and -9 Burial Ground radiation zone. The work included viewing aerial photographs and construction prints, analyzing plant growth patterns, and load testing the ground surface with a 40-ton vehicle. As a direct result of the research, four previously unrecorded trenches within the burial grounds were identified: 218-E-2A, 218-E-5, 218-E-5A, and 218-E-9 (Maxfield 1979; WHC 1991a).

The entire burial ground has been stabilized. Burial grounds 218-E-2, -5, -5A, and -9 were stabilized together as one large field. Burial grounds 218-E-2A and 218-E-4 were stabilized independently. Contaminated equipment previously stored above ground in these burial grounds was removed and transported to the 218-E-10 Burial Ground for further storage or burial. A minimum 0.3 m (1 ft) layer of soil and sand depth was distributed over the trenches.

The soil was fertilized and a mixture of perennial grasses was planted in October and November 1980 (WHC 1991a). The re-vegetation efforts were hampered by poor weather conditions in the late fall.

2.3.9.3 218-E-2A Burial Ground. The 218-E-2A Burial Ground was active from 1945 to 1955 and contains one trench (WHC 1991a). No records or burial inventories are available to indicate that the 218-B-2A site was ever used as a burial ground. It was used, however, as an above-ground storage site for regulated equipment (Maxfield 1979).

An inspection of the burial site performed in February 1978 disclosed a number of sink holes along the center line of the trench, indicating that it had been used for dry waste burials (Maxfield 1979). In 1979, soil was placed over the burial site to bring the surface of the depressions to ground level.

2.3.9.4 218-E-3 Burial Ground. The 218-E-3 Burial Ground was located in the extreme southwestern corner of the 200-SS-1 Operable Unit, and was active only in 1954. The burial ground received construction scrap including metal slip forms, barrels, and timbers from the 202-A Building construction work that had been contaminated with ^{106}Ru released from the REDOX Stack. In 1971, the pit was uncovered and surveys found that no measurable alpha, beta, or gamma activity remained in the soil or on the equipment. The burial ground was exhumed and removed from radiation zone status.

2.3.9.5 218-E-4 Burial Ground. The 218-E-4 Burial Ground was thought to have consisted of two trenches; however, load testing during stabilization failed to identify clearly defined trenches. Maxfield (1979) reports that construction and repair wastes were buried here, and indicates that the number of trenches is unknown. Some contaminated equipment that was stored here was removed. Radionuclides believed to have been disposed to the trenches include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium. The burial ground was stabilized with the others around it.

2.3.9.6 218-E-5 Burial Ground. The 218-E-5 Burial Ground consists of two trenches. Trench 1 is 100 m (325 ft) long and 3.3 m (11 ft) wide at the bottom. Trench 2 is 100 m (325 ft) long and 40 m (125 ft) wide at the bottom. The burial ground received failed equipment, industrial dry waste, and small boxes. The north end contains railroad boxcars contaminated with uranyl-nitrate-hexhydrate. Radionuclides released to the trench include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium. The burial ground was stabilized with the others around it.

2.3.9.7 218-E-5A Burial Ground. The 218-E-5A Burial Ground is west of the 218-E-5 Burial Ground, and consists of several backfilled trenches with a surface area of 220,000 ft^2. In 1956, the 218-E-5 Burial Ground received waste from L Cell, known as the 202-A Building Burial Package, in the form of four large boxes containing failed equipment and industrial wastes. One of the boxes was damaged while unloading, and the contents were pushed into the trench. The D-2 Column from the 202-A Building K Cell was buried in this site as well (Maxfield 1979). Radionuclides released to the trench include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium. The area was stabilized with the other trenches around it.

2.3.9.8 218-E-6 Burial Ground. In the fall of 1955 a shack and other wooden items were collected from the 291-B Stack area and placed in the 218-E-6 Burial Ground. The burial ground is a 1.2 m (4 ft) deep trench. The collected material was burned and the ashes covered. Later the burial ground was exhumed and stabilized by seeding with wintergraze, crested, Siberian, and thickspike wheatgrasses. The burial ground has since been released from radiation zone status.

2.3.9.9 218-E-7 Burial Ground. The 218-E-7 Burial Ground is located about 30 m (100 ft) south of the 222-B Building. It consists of three underground vaults containing about 170 m^3 of mixed fission products and TRU solid mixed waste deposited from 1947 until 1952. Two of the vaults are 0.9 m^2 (10 ft^2) by 4 m (12 ft) deep constructed of 5 x 5 cm (2 x 2 in.) wooden planking. The top of each vault is 1.5 m (5 ft) below grade and both have open bottoms. The third vault is an 2.4 m (8 ft) diameter concrete culvert pipe 8 m (25 ft) deep.

The pipe has a 22 cm (9 in.) thick concrete cover and a 30 cm (12 in.) thick concrete floor. Radionuclides contained within the waste include ^{137}Cs, ^{106}Ru, ^{90}Sr, plutonium, and uranium (Anderson et al. 1991). The wooden vaults create a collapse potential.

Currently, the burial ground is approximately 4.6 m (15 ft) wide by 9 m (30 ft) long and is delimited by a light-weight chain barricade with surface contamination and potential cave-in hazard warning signs. The southern edge of the burial ground is adjacent to a small outdoor Kaiser Engineers storage site. Non-native grass and Russian thistle cover approximately 70% of the delimited surface.

2.3.9.10 218-E-9 Burial Ground. The 218-E-9 Burial Ground is located with the 218-E-2, -2A, -4, -5, and -5A group. This burial ground was an above-ground storage site for fission product equipment that became contaminated in the uranium recovery program at the tank farm. It never appears to have been a burial ground (Maxfield 1979).

2.3.9.11 218-E-10 Burial Ground. The 218-E-10 Burial Ground is the current, active burial ground for the B Plant facility. It is located in the 200-BP-10 Operable Unit in the northwest corner of the B Plant Aggregate Area. It is about 610 m (2000 ft) northwest of the B Plant separations building. The burial ground became active in February 1960, and is also known as 200 East Industrial Waste No. 10.

This waste management unit will consist of 17 north-south running trenches and one east-west running trench. The east-west trench has bottom dimensions of 30.5 m (100 ft) by 4.6 m (15 ft). North-south trench 1 is 400 m (1300 ft) by 4.6 m (15 ft) and is 7.3 m (24 ft) deep. North-south trenches 2 through 8 are 250 m (805 ft) to 350 m (1145 ft) long by 4.9 m (16 ft) and are 4.6 m (15 ft) deep. North-south trenches 9 through 17 are empty at this time.

The 218-E-10 Burial Ground has received 21,764 m^3 of solid, mixed waste consisting of mixed industrial wastes, failed PUREX equipment, 69 PUREX cover blocks, and 4 PUREX centrifuge blocks. The burial ground is partially stabilized.

2.3.9.12 200-East Area Construction Pit. From 1945 through 1955, the 200-East Area Construction Pit, located west of the 200 East Area fence was used as a nonhazardous solid waste pit for broken blocks of concrete foundation and other structures (WHC 1991a). There have been no known chemicals dumped into this unit (Stenner et al. 1988). The large gravel pit has been abandoned. Native vegetation now grows in and around the pit excavation.

2.3.9.13 200-E8 Borrow Pit Demolition Site. The 200-E8 Borrow Pit, an active thermal treatment (detonation) pit, became operational in August 1984. It is a RCRA facility located southwest of the 218-E-10 Burial Ground, west of the 200 East Area fence, and just north of the 200-East Area Construction Pit. The 200-E8 Borrow Pit had the following detonations in 1984: Isopropyl Ether 8 L, 1,4-Dioxane 1,250 mL, 2-Butoxyethanol 19 L, Methyl Ethyl Ketone 177 mL, Hydrogen Peroxide 11.36 L, Dioxane 946 mL, Sodium Azide 473 mL, and Phosphoric Acid 189 L. No detonations took place in 1985 or 1986.

2.3.10 Unplanned Releases

Sixty-two unplanned releases are included in the B Plant Aggregate Area. Most of the releases have been included in the Tri-Party Agreement or are associated with an existing waste management unit. These unplanned releases and their associated waste management units will be addressed together in this study. Table 2-6 summarizes the known information for each unplanned release and, where applicable, lists the waste management unit to which it is related. Most of the information available for the unplanned releases is derived from the WIDS sheets. The locations of all the unplanned releases in the B Plant Aggregate Area are shown on Figures 2-12 and 2-13.

2.4 WASTE GENERATING PROCESSES

Several processes have operated in the B Plant Aggregate Area since the construction of the original 221-B Building in 1945.

The 221-B Building (B Plant) was the second fuel reprocessing plant at the Hanford Site to separate plutonium from other fission products. The 221-B Building originally used the bismuth phosphate process to recover plutonium from irradiated uranium fuel pellets and operated from 1945 to 1952. In 1968, the plant was restarted with a new process to recover cesium and strontium from single-shell tank wastes. The plant continued this mission until 1984. The 221-B Building also has a low-level radioactive waste concentration process that reduces the volume of wastes by evaporating water from them. This process has not been utilized since 1986. The 225-B Building includes the WESF, which was designed to convert strontium and cesium solutions that were recovered at the 221-B Building, crystallize them, and store them in stainless steel cylinders that are immersed in a cooling water bath. Other waste generating processes B Plant Aggregate Area include the 242-B Evaporator used to reduce liquid volume in single-shell tanks and two ITS Units (ITS-1 and ITS-2) that directly evaporated water from single-shell tanks. Equipment conversions were made at 221-B Building beginning in 1986 to process NCAW and a test quantity of 80,000 L (20,000 gal) was processed.

Figure 2-14 shows the historical timelines for the waste generating processes. Table 2-7 summarizes the available information about the waste streams produced within the aggregate area. The chemicals or radionuclides that are known or suspected to be in the B Plant Aggregate Area waste streams are listed in Table 2-8 and Table 2-9 lists radionuclides, organic and inorganic chemicals disposed of at the B Plant Aggregate Area waste management facilities. These lists have been compiled from inventory data, sampling data and process descriptions. Section 2.4.1 through 2.4.11 describe the B Plant Aggregate Area waste generating processes in more detail.

2.4.1 221-B Building Bismuth Phosphate Plutonium Recovery Process

This was the original process for which the 221-B Building was designed and constructed in 1945. This process was designed to separate and concentrate the small amounts of plutonium contained in the irradiated fuel pellets produced in the 100 Area reactors. In the bismuth phosphate process, all of the material contained within the irradiated fuel pellets was discarded as waste except for the recovered plutonium.

The first step in the bismuth phosphate process was to remove the aluminum cladding surrounding the fuel. This was done by dropping the pellets into a tank containing a solution of sodium hydroxide which preferentially dissolved the aluminum surrounding the pellet. Sodium nitrate was added to the solution to prevent the formation of excessive quantities of hydrogen gas during the dissolution of the aluminum metal. The waste solution from the cladding dissolution step contained sodium aluminate, sodium nitrate, and sodium nitrite as well as small amounts of fission products. This waste solution was combined with the first-cycle decontamination waste and transferred to single-shell tank storage (Waite 1991).

The next step in the process was to dissolve the uranium and extract the plutonium. The decladded uranium slugs were rinsed with water and dissolved in 50 to 60% nitric acid. Excess uranium metal remained in the dissolver as a heel to increase the rate of dissolution. The completion of the dissolving step was determined by specific gravity that was measured with a pair of bubbler tubes immersed in the solution (Ballinger and Hall 1991).

The plutonium was recovered from the dissolved uranium solution by adding sodium nitrate solution to convert the plutonium to the +4 valence state. Next, bismuth nitrate and phosphoric acid were added. Sulfuric acid was also used at this point in the process. The resulting precipitate of bismuth phosphate carried 99% of the plutonium with it. This precipitate was separated from the solution in a solid-bowl centrifuge, and the solution was transferred to single-shell tank storage as the metal waste stream (Ballinger and Hall 1991). The metal waste stream contained the bulk of the uranium and approximately 90% of the long-lived fission products (e.g., ^{137}Cs and ^{90}Sr) (Waite 1991).

Once the plutonium had been extracted in the precipitate, it went through two decontamination cycles to purify it further. In the first decontamination cycle, the precipitate was washed in the centrifuge and dissolved in strong nitric acid. The valence of the plutonium was then adjusted to +6 by the addition of a sodium dichromate solution and a precipitate of bismuth phosphate was again formed using bismuth nitrate, phosphoric acid, and sodium metabismuthate. However, this time the precipitate captured some of the fission products that were not extracted in the first liquid waste stream and the plutonium remained in solution. The precipitate was separated from liquid product stream, dissolved in nitric acid, and transferred as a liquid to be mixed with other liquid wastes from the first decontamination cycle.

Following separation from the waste precipitate, a precipitate containing the plutonium was formed from the product solution using ammonium fluosilicate, ferrous ammonium sulfate, bismuth oxynitrate, and phosphoric acid. The plutonium-containing precipitate was separated from the solution and the solution was transferred to single-shell tank storage along with the other liquid wastes from the first contamination cycle. The plutonium product precipitate was dissolved in nitric acid prior to further processing (Ballinger and Hall 1991). The waste stream from the first decontamination cycle contained almost 10% of the long-lived fission products and was sent to single-shell tank storage (Waite 1991).

The second decontamination cycle was performed on the plutonium solution remaining from the first decontamination cycle to further purify it by removing additional fission products from the plutonium solution. The same process was used for the second decontamination cycle as was used for the first decontamination cycle. The waste stream from the second cycle contained less than 0.1% of the fission products. This was sent to single-shell tanks for storage until 1948. Because of limited tank space, the second-cycle waste supernatant was discharged directly to cribs and trenches from 1948 until the 221-B Building was shutdown in 1952. This included second cycle material that had previously been stored in tanks (Waite 1991.)

The product from the bismuth phosphate process was a dilute plutonium nitrate solution. This was transferred to the 224-B Concentration Facility to be purified and reduced in volume. The solution was first oxidized with sodium bismuthate. Next, phosphoric acid was added to precipitate byproduct followed by centrifugation. Product solution was treated with hydrogen fluoride and lanthanum salt to precipitate by-product. Following separation by centrifuge, product solution was treated with oxalic acid, hydrofluoric acid, and lanthanum salt to precipitate plutonium and lanthanum fluoride. These solids were centrifuged from the solution and washed with water. The plutonium fluoride was metathesized to plutonium hydroxide by digestion with hot potassium hydroxide. The solid hydroxides were centrifuged and dissolved in nitric acid to form plutonium nitrate, which was transferred in cans to the Isolation Building (the 231-Z Building in the Z Plant Aggregate Area).

The plutonium nitrate-lanthanum nitrate solution sent to the Isolation Building was treated with ammonium sulfite and sulfate. It was treated with hydrogen peroxide to form plutonium peroxide in two precipitations followed by dissolving in nitric acid. The final plutonium nitrate was concentrated in a still and then concentrated in a sample can by evaporation to a thick paste. The liquid waste stream from the 224-B Concentration Facility concentration processing was initially discharged to the 241-B-361 Settling Tank when processing began in 1945. The overflow from the settling was discharged to the 216-B-5 Reverse Well.

Beginning in 1947, the 224-B Concentration Facility waste was routed to the 241-B-201 through 241-B-204 (208,000 L, 55,000 gal capacity) Single-Shell Tanks for settling before being discharged to cribs. This discharge continued until the bismuth phosphate process was shut down in 1952. The primary concern about the waste streams from the 224-B Concentration Facility was plutonium. The majority of the plutonium remained in the tanks after settling. However, the waste from this facility was the primary contributor of plutonium to the ground from all of the tank waste discharges (Ballinger and Hall 1991). Figure 2-15 schematically shows the fuel separations processing at the 221-B Building between 1945 and 1954.

2.4.2 221-B Building Strontium and Cesium Recovery

In 1963, the 221-B Building began recovering strontium, cerium, and rare-earths using an acid-side, oxalate-precipitation process as part of the Phase I processing for the 221-B Building Waste Fractionization Project. A centrifuge was used to separate the phases. The lead, cerium, and rare-earth fractions were dissolved in nitric acid and stored. The strontium fraction was thermally concentrated and stored. Portions of the strontium and rare earths produced in Phase I were pumped by underground transfer line to the Semiworks for purification of the ^{90}Sr fraction and separation of the rare-earth fraction in ^{144}Ce and a rare-earth fraction including ^{147}Pm. Phase I processing at the 221-B Building ended in June 1966 to accommodate Phase III construction.

The objective of the Phase I processing was to restore services to the 221-B Building after its extended shutdown and to accumulate an inventory of fission products. The Phase II portion of the project was the installation of facilities necessary to demonstrate a process system for packaging the long-lived fission products as a small volume concentrated waste. The purpose of Phase III was to provide waste fractionization facilities in the 221-B Building for processing high level wastes from PUREX Plant Aggregate Area and the B Plant

Aggregate Area tank farms into fractions that could be immobilized and contained more safely.

The Phase III Waste Fractionization processing began at the 221-B Building in 1968. This process separated the long-lived radionuclides, ^{90}Sr and ^{137}Cs, from high-level PUREX and REDOX wastes and stored a concentrated solution of ^{90}Sr and ^{137}Cs at the 221-B Building. Individual tanks at the B Plant Aggregate Area contained up to 35 megacuries of ^{90}Sr or ^{137}Cs at concentrations up to 10,000 Ci/gal. The combined storage capacity of the tanks was estimated to be 85 megacuries of ^{90}Sr and 25 megacuries of ^{137}Cs.

Three processes were used for the waste fractionization. The first process was the feed preparation and solvent extraction of current acid wastes generated by the 202-A Building and stored at PUREX Plant Aggregate Area and REDOX tank farms. The solids in these wastes contained about 55% of the strontium and 70% of the rare earths. The solids, consisting mostly of silicates, phosphates, and sulfates, were treated by a carbonate-hydroxide metathesis solution to convert the sulfates to carbonate-hydroxide solids. These solids were then separated from the solution by centrifuge and dissolved in nitric acid to recover the fission products. The dissolved fission products were combined with original acid waste supernate after it had been treated to form feed for the solvent extraction columns by adding a metal-ion complexing agent, a pH buffer, and a pH adjustment solution (Bixler 1967).

The feed went through a series of solvent extraction columns. The solvent used was a mixture of di(2-ethylhexyl) phosphoric acid extractant and tributyl phosphate modifier in a normal paraffin hydrocarbon diluent. The strontium, cerium, and other rare earths were extracted from the aqueous phase into the solvent. The aqueous fraction contained the cesium and was routed to the 241-A or 241-AX underground tank farms in the PUREX Plant Aggregate Area for temporary storage to allow the decay of short-lived activity (Bixler 1967).

The strontium fraction was stripped from the solvent with dilute nitric acid and thermally concentrated with the Cell 5 concentrator for storage in tanks in the 221-B Building Cells 6-8. The cerium and rare-earth fraction was stripped from its solvent with nitric acid, combined with organic wash wastes, and sent to single-shell tank storage. The solvent was washed and recycled for reuse.

The second process used was a feed preparation and solvent extraction process for processing stored sludge wastes from the 241-A, 241-AX, and 241-SX Tank Farms. The sludge was sluiced with supernate and water and pumped out of the tanks to the 244-AR or 244-SR Vault. At these vaults, the sluicing water was decanted for storage to await treatment for cesium removal. The sludge, containing the bulk of the fission products, was dissolved in nitric acid and transferred to the 221-B Building for treatment.

At the 221-B Building, the rare-earths and strontium were precipitated as sulfates using lead sulfate as a carrier to separate them from iron and aluminum. A sodium hydroxide-sodium carbonate metathesis was performed to convert the sulfates to hydroxides and carbonates and to eliminate the bulk of the lead. The product cake was centrifuged, dissolved with nitric acid, and accumulated for solvent extraction treatment. The solvent extraction was similar to the solvent extraction for the current acid waste, except that the waste aqueous fraction from the initial solvent extraction containing the rare-earths and the solvent wash wastes were thermally concentrated at the 221-B Building using the Cell 20 concentrator and transferred to immobilization processing (in-tank solidification).

The third waste fractionation process was the ion exchange of stored cesium supernates and sluicing solutions. High-level tank farm supernates and sluicing water containing ^{137}Cs was passed through an ion-exchange column at the 221-B Building. The cesium and a small fraction of sodium were adsorbed on a synthetic alumino-silicate zeolite. About 97% of the adsorbed sodium and 0.5% of the loaded cesium were designed to be removed from the column with a dilute ammonium and carbonate-ammonium hydroxide scrub solution (Bixler 1967). Following this, the remaining cesium was removed with a concentrated mixture of ammonium carbonate and ammonium hydroxide. The cesium was thermally concentrated in the Cell 20 concentrator and stored in tanks in 221-B Building Cells 14 and 17. The waste from the adsorption step was routed directly to in-tank solidification. The column wash wastes and scrubs were thermally concentrated in the Cell 23 concentrator prior to transfer to in-tank solidification. In 1974, the 221-B Building began using Cell 38 to perform final purification of the cesium prior to processing at the WESF. The WESF is described in Section 2.4.4. The strontium solvent extraction process operated until 1978. Cesium final purification was ended in 1983 and strontium purification was ended in 1984.

Wastewater continues to be generated from the 221-B Building from heating, ventilation, and air conditioning (HVAC) systems, floor drains, and steam condensate drains. This stream is known as the B Plant Chemical Sewer Stream and was disposed of to the 216-B-2-2 Ditch and the B Ponds until UN-200-E-138 forced the closure of that ditch. From 1970 until February 1992, it was disposed of to the 216-B-63 Ditch. In February 1992, the effluent piping was revised to allow the chemical sewer stream to be discharged to the B Plant Cooling Water Stream which ultimately reaches the 216-B-3 Pond. This waste stream is not specific to any process, and would have been generated throughout B Plant operations.

2.4.3 221-B Building Waste Concentration Process

The waste fractionization process described in Section 2.4.2 included a thermal evaporation concentrator in Cell 23 to concentrate process wastewaters prior to disposal. This system was used to concentrate low-level radioactive waste after the cesium and strontium waste fractionization process was shut down in 1984. Double-shell tank waste was received at the 221-B Building to be processed through the low-level waste concentrator until 1986. The 221-B Building received no double-shell tank wastes after April 1986 and processing of these wastes was complete by late 1986. Other sources of the low-level waste included miscellaneous sumps and drains in the WESF, which diverted decontamination waste solutions generated in the WESF process cells. Another contributor was a liquid collection system located beneath the 40 cells in the 221-B Building that collected cell drainage from decontamination work and water washdowns in the processing section of the 221-B Building. The concentrator also processed wastes produced by the cleanout of various process vessels at the 221-B Building and WESF through 1986 (Peterson 1990a).

The concentrator process consisted of a vertical, single-pass, shell-and-tube thermal-recirculated and steam-heated evaporator. The evaporator had two bundles of tubes that contained low-pressure steam to heat the process feed. The tube bundles heated the feed to the boiling point and vaporized it. The evaporated liquid passed through a high-efficiency deentrainer to remove entrained liquid droplets and was condensed as process condensate (Peterson 1990a). The process condensate was disposed of in the 216-B-12 Crib beginning in May 1967 when disposal to the 216-B-12 Crib began again. In November 1973, the process condensate was diverted to the 216-B-62 Crib. Disposal continued to this crib until the concentrator was shut down (RHO 1986). The process condensate is known as the B Plant Process Condensate Stream. It was not generated before the waste concentration process.

The steam that was used to heat the feed was condensed by the heating process and was collected as steam condensate. The steam condensate was disposed of to 216-B-3 Pond until September 1967. In 1967, it was diverted to the 216-B-55 Crib (Peterson 1990b). The steam condensate is known as the B Plant Steam Condensate Stream. Prior to the waste concentration process, steam would have been used in other processes and condensate would have been disposed of to cribs or ponds.

The liquid remaining in the evaporator was reduced in volume by the removal of water through evaporation. The concentrated liquid waste was transferred to tank farm storage. The concentrator was shut down in January 1987 for repairs to its deentrainment system (Peterson 1990b). The concentrator was restarted in April 1988 and over 2,000,000 L (500,000 gal) of flush water were processed through the concentrator to ensure that residuals from past processing were removed. The flush water was disposed of in double-shell tank underground storage (Peterson 1990a). At the present time, the low-level waste from B Plant is disposed of to double-shell tank storage.

2.4.4 225-B Building Waste Encapsulation and Storage Facility

Four processes were undertaken at the WESF in the 225-B Building located west of, and attached to, the 221-B Building. Three processes have been discontinued and one process, capsule storage, is still in operation. The first process was to convert purified cesium carbonate to cesium chloride. The cesium carbonate was converted to cesium chloride by the addition of 12 M hydrochloric acid. Carbon dioxide and heat were released during the reaction. The cesium chloride solution was cooled with a cooling coil and air sparging through mixing. The offgas from the acidification process was vented through a deentrainer, condenser, and a scrubber which neutralized the hydrochloric acid. The cesium chloride solution was transferred to an electrically heated melter crucible which boiled the liquid away and then melted the cesium chloride salt. The molten cesium chloride was poured into capsules.

The second process was the process used to convert strontium nitrate to strontium fluoride. The strontium nitrate was transferred to a precipitation tank and powdered sodium fluoride was added to precipitate the strontium as a slurry of strontium fluoride. The slurry was filtered to produce a cake that was allowed to dry and self-heat. The cake was loaded into a furnace boat which was placed into a furnace at a sintering temperature of 800 °C (1,472 °F) to remove water and nitrate volatiles. The sintered strontium fluoride was dumped or air chiseled out of the furnace boat and loaded into a capsule and compacted.

The third process was the encapsulation of the strontium and cesium. Two capsules were used to encapsulate the material, an inner capsule which contained the cesium or strontium, and an outer capsule which enclosed the inner capsule. The capsules arrived at the WESF with one end welded on. Ultrasonic inspection was performed by the manufacturer to verify weld penetration. At the WESF, the capsules were first degreased with acetone and weighed. After the inner capsule was filled it was purged with helium and sealed by welding a cap on the open end. Weld inspection was done visually and by a helium leak detection process in a vacuum chamber. A final check was done using a bubble test.

Following testing, the capsules were decontaminated by placing them in a capsule scrubber and an electropolisher. After decontamination, the capsule was placed into an outer capsule and a cap was welded onto the open end of the outer capsule. The outer capsules were subjected to additional inspections using ultrasonic scanning followed by calorimetry to determine curie levels. The finished capsule was weighed and the known weights of the inner and outer capsules subtracted. The net weight of the capsule content was divided into the curie content to give the curie output per gram. Capsules that did not pass testing were disassembled and reworked. The contents were removed from the defective capsule and the process was repeated. The rejected capsule was discarded as solid waste.

The final process conducted at the WESF is capsule storage. The finished capsules were smear sampled for loose residual contamination and decontamination if necessary. A surface contamination of less than 200 ct/min was required before the capsule could be stored in the capsule storage area. The completed capsule transferred to one of 8 capsule storage pools using pool cell tongs. The capsule was transferred through a transfer aisle filled to a depth of 3 m (9 ft) with demineralized water and placed in one of the storage pools that was filled to a depth of 3.3 to 4 m (11 to 13 ft) of water. The water provides both radiation shielding and a means of removing heat generated by the radioactive decay of the capsule contents. Each storage pool contains a vertical turbine pump that circulates the pool water continuously. The recirculated water passes through the tube side of a heat exchanger and is returned to the bottom of the pool cell. Raw water passes through the shell side of the heat exchanger to cool the pool water. If pool water becomes contaminated, it is diverted to the 221-B Building low-level waste header (see Section 2.4.3). The time-averaged flowrate of pool cell water diverted to the low-level waste header is .07 liters/min (.02 gpm). This flowrate also includes water from additional WESF sources such as cell drains and floor drains (WHC 1992b). The raw water that is used for cooling passes through the heat exchanger and is discharged through the 216-B-2-3 Ditch to the 216-B-3 Pond. Provisions exist to divert the cooling water to the 216-B-63 Crib in an emergency. The flowrate of cooling water used for WESF capsule storage cooling is about 5.7 m^3/min (1,500 gal/min) (Peterson 1990c). The cooling water is known as the B Plant Cooling Water Stream, cooling water has been generated in other processes at B Plant and related facilities.

Processing began at the WESF in 1974. The strontium, cesium, and encapsulation processes were ended in 1984. The capsule storage process continues to operate to maintain the inventory of capsules in storage at the WESF.

2.4.5 242-B Evaporator System

In December 1951, the 242-B thermal evaporation system was placed into operation at a location south of the 241-B Tank Farm. The evaporator was installed to evaporate cladding/first cycle waste and reduce the waste volume (Waite 1991). The evaporator was a steam-heated pot evaporator that operated at atmospheric pressure (Jungfleisch 1984). The liquors were partially boiled down to produce a more concentrated waste. The water that was evaporated from the waste was discharged as 242-B Evaporator process condensate to the 216-B-11A and 216-B-11B Reverse Wells. The evaporator bottoms were initially placed into single-shell tank storage (Anderson 1990). In 1954, evaporator bottoms from the 242-B Evaporator began being discharged to the 216-B-37 specific retention trench (Maxfield 1979). The 242-B Evaporator was shut down in December 1954 and was never restarted (Anderson 1990).

2.4.6 In-Tank Solidification Process

Two in-tank solidification units were installed in the 241-BY Tank Farm. The objective of the in-tank solidification units was to heat waste liquors while they were inside of a single-shell tank and remove water leaving a solid salt cake behind in the tank. The first unit, ITS-1, began operation in March 1965. It used a hot air sparge into the tank. The air sparging was done on one individual tank. The hot air caused water in the tank to evaporate and leave the tank with the air while leaving the solids behind (Anderson 1990). The evaporated water was condensed and discharged to the 216-B-50 Crib. The cooling water was discharged to the 216-B-2-2 Ditch.

The second unit, ITS-2 began operation in February 1968. This unit used electrical immersion heaters to heat the tank contents. The heated liquor was then transferred to other tanks. In August 1971, ITS-1 was modified to become a cooler for ITS-2. Both units were shut down in June 1974.

2.4.7 Wastes Generated at the 221-U Building

In 1952, the previously unused 221-U Building began operation with a process using tributyl phosphate in a kerosene (paraffin hydrocarbon) diluent to recover uranium metal from metal waste that was in single-shell tank storage at the 221-B and 221-T Buildings. The aqueous phase waste stream from the solvent extraction process was neutralized with sodium hydroxide and transferred to the B Plant Aggregate Area for storage in single-shell tanks.

In addition to tributyl phosphate wastes, evaporator condensate from the 221-U Building was transferred to the 216-B-12 Crib for disposal between November 1952 and December 1957. Lanthanum fluoride wastes from the 221-U Building were also stored in single-shell tanks in the 241-B Tank Farm.

2.4.8 In-Tank Scavenging

A ferrocyanide scavenging process was began in 1954 to attempt to reduce the volume of wastes that had to be stored in single-shell tanks. The objective of the scavenging process was to precipitate the soluble long-lived ^{137}Cs from the 221-U Building uranium recovery waste supernatant that had been stored in B Plant Aggregate Area single shell tanks. The other principal long-lived fission product, ^{90}Sr, was already essentially insoluble in the neutralized uranium recovery waste and precipitated without adding scavenging chemicals. However, during the later operational years of the process, calcium nitrate or strontium nitrate were added to enhance the precipitation of the ^{90}Sr.

After precipitation, the waste was allowed to settle in single-shell tank storage and the solid precipitate particles settled to the bottom of the tanks as sludge. Following settling, the supernate was decanted from the sludge, tested for the applicable discharge requirements, and discharged to the ground.

Beginning in 1954, the newly-generated uranium recovery waste was scavenged in the 221-U Building and transferred to the B Plant Aggregate Area for settling in the single-shell tanks. Then it was discharged to the ground either through cribs or specific retention trenches. This scavenging process was ended in June 1957.

Starting in May 1955, scavenging was also done on 221-U Building tributyl phosphate wastes that had previously been stored in single-shell tanks. The wastes were pumped to the 244-CR Vault in the PUREX Plant Aggregate Area where they were scavenged. The waste was then routed back to single-shell tanks for settling and the supernatant subsequently was pumped to the ground. This was referred to as "in-tank farm" scavenging. The scavenging in the 244-CR Vault ended in December 1957 and the last of these wastes was discharged to the ground in January 1958 (Waite 1991). Waste management units that received tributyl phosphate waste are the 216-B-14 through 216-B-19 Cribs, the 216-B-20 through 216-B-34 Trenches, the 216-B-42 Trench, the 216-B-43 through 216-B-49 Cribs, and the 216-B-52 Trench. Figure 2-16 schematically shows the interrelationships between the 221-U Building processing and the in-tank scavenging process.

2.4.9 Wastes Generated at the 202-A Building

The 202-A Building produced coating wastes from the dissolution of the irradiated fuel pellet cladding that were disposed of to single-shell tanks in the 241-B and 241-BY Tank Farms.

2.4.10 Wastes Generated at S Plant

The S Plant operated between 1951 and 1967 and used an MIBK solvent extraction process to accomplish the separation of uranium and plutonium from the irradiated fuel pellets. High level wastes were transferred to the 241-B-103 Single-Shell Tank. Waste from ion exchange processing was transferred to the 241-BX-101, 241-BX-103, and 241-BX-106 Single-Shell Tanks storage.

2.4.11 Analytical Laboratory Programs

The 222-B Laboratory supported operations at the 221-B Building complex and other 200 Area facilities with laboratory services. A liquid waste stream was generated from the laboratory facility that included sample disposal waste and hood and hot cell cleanup waste. Sampling and testing equipment, gloves, empty containers, and other materials were buried as solid waste. Laboratory liquid wastes were directed to the 216-B-6 Reverse Well from April 1945 to December 1949 and to the 216-B-10A Crib from December 1949 to January 1952.

2.5 INTERACTIONS WITH OTHER AGGREGATE AREAS OR OPERABLE UNITS

The B Plant Aggregate Area dominates the 200 East Area and is comprised of three non-contiguous segments: the main plant area to the west (200-BP-1 to 10 and 200-SS-1 Operable Units), the B Plant Aggregate Area pond area (200-BP-11 Operable Unit) to the east; and the Gable Mountain Pond (200-IU-6 Operable Unit) to the north. Located between the east and west segments are the PUREX Plant Aggregate Area and the Semiworks Aggregate Area.

- The PUREX ("plutonium-uranium extraction") process (202-A Building) succeeded both the original bismuth phosphate and REDOX processes for fuel separation. The 202-A Building operated from 1956 to 1972 and from 1983 to 1988 and was put on "standby" in 1990. The process utilized tributyl phosphate extraction and reduced overall waste volumes at the expense of increased high-level waste volume.

- The Semiworks Aggregate Area was a plutonium-uranium extraction pilot-plant area where process development and process improvement operations for the REDOX and PUREX processes were performed. Criticality tests were also performed at the Semiworks Area.

From 1952 to 1958, the B Plant Aggregate Area single-shell tank farms supplied the raw material for the uranium recovery mission taking place at the 221-U Building. Metal wastes stored in the single-shell tanks were sluice-mined from the tanks, dissolved with nitric acid, and transferred to the 221-U Building where uranium was recovered by the tributyl phosphate/NPH extraction process.

In 1956 high ^{60}Co concentrations in the groundwater beneath the cribs receiving the uranium recovery wastes from the U Plant Aggregate Area necessitated the transfer of the process supernatant back to the B Plant Aggregate Area where it was discharged to 16 specific retention trenches and 6 specific retention cribs located in the 200-BP-2 Operable Unit and the BY cribs located in the 200-BP-1 Operable Unit. This practice continued until the completion of the uranium recovery mission in 1958. The area surrounding the trenches and cribs is a controlled area designated UN-200-E-83.

From 1968 to 1978, during the B Plant Aggregate Area's second mission, waste from the PUREX Plant Aggregate Area waste storage tanks was used to recover ^{90}Sr and ^{137}Cs for space and medical applications. High-level sludge from the twelve self-boiling PUREX Plant Aggregate Area tanks yielded ^{90}Sr; the supernatant was used to recover ^{137}Cs. The remaining waste was evaporated, with condensate discharge to the ground and concentrate returned to the tanks.

Over the years there have been numerous high-level liquid waste transfers into and out of the B Plant Aggregate Area single-shell tanks involving other aggregate areas. As a result, the 241-B, 241-BX, and 241-BY Tank Farms contain wastes with a broad background of origin, type, treatment, and age. Inputs have included PUREX coating wastes, PNL waste, REDOX high-level waste, ion exchange waste, double-shell slurry feed from the 241-S and 241-SX Tank Farms, and organic wash waste.

The B Plant Aggregate Area operable unit 200-BP-8 consists primarily of several east-west running ditches whose boundary protrudes well into the 200-PO-6 Operable Unit of the PUREX Plant Aggregate Area. Several unplanned release sites (UPR-200-E-24, UPR-200-E-30, UPR-200-E-50) exist along this protrusion and may have contributed to some inter-area contaminant migration. An underground pipe completes the crossing of the 200-PO-6 Operable Unit and into the 216-B-3 Pond system in the 200-B-11 Operable Unit.

The 216-B-3 Pond, and its three auxiliary overflow ponds 216-B-3A, 216-B-3B, and 216-B-3C received cooling water and low-level liquid waste from the 221-B Building. These ponds also received 202-A Building wastes via the 216-A-29 Ditch. Typical PUREX Plant Aggregate Area wastes included cooling water from 244-AR and 244-CR Vaults and process wastes from the 242-A Evaporator and the 202-A Building. All four ponds are still classified as active units.

The 200 East Area Construction Pit lies just west and outside of the fenceline border of the B Plant Aggregate Area. Located one-half mile west of the pit and also outside the aggregate area is the 241-EW-151 Diversion Box. Near these two locations is the future site of the Hanford Waste Vitrification Plant to be located within the 200-BP-9 Operable Unit.

The 200-IU-6 Operable Unit lies north of the main B Plant Aggregate Area and consists of the 216-A-25 Pond (Gable Mountain Pond) and the 216-N-8 Pond (West Lake). Gable Mountain Pond received cooling water from the PUREX Plant and low-level liquid waste from the 242-A Evaporator, the 244-AR Vault, and the 241-A Tank Farm. It has been filled-in and is no longer functional. West Lake exists but has always been inactive.

2.6 INTERACTION WITH RESOURCE CONSERVATION AND RECOVERY ACT PROGRAM

Appendixes B and C of the Tri-Party Agreement (Ecology et al. 1990) list RCRA TSD facilities on the Hanford Site that have entered interim status and, thus, will require final permitting or closure. Within the geographical extent of the B Plant Aggregate Area there are a number of facilities that fall into this category.

The 216-B-3 Pond system, the 2101-M Pond, the 200-E-8 Borrow Pit, the 216-B-63 Trench, and the 241-B, -BX, and -BY Tank Farms are all to be closed. Operating permits are to be sought for the 244-BX Receiver Tank, the 218-E-10 Burial Ground, and a number of B Plant Aggregate Area facilities including the Waste Concentrator, the Radioactive Organic Waste Solvent Tanks (tanks 1 through 7), the Storage Area, and the Waste Piles in and around the 221-B Building.

The 216-B-3 Pond system includes ponds 216-B-3, 216-B-3A, 216-B-3B, 216-B-3C, and the 216-B-3-3 Ditch. All these facilities are identified as RCRA TSD units because of their long term use for disposal of low-level mixed wastes. The Closure/Post Closure Plan was to have been submitted to Ecology and EPA in March 1990 (Figure D-1, page 17 of Tri-Party Agreement). Unplanned releases UN-200-E-14, UN-200-E-32, UPR-200-E-34, UPR-200-E-51, and UPR-200-E-138 are all associated with the 216-B-3 Pond system.

The 200-E-8 Borrow Pit Demolition Site Closure Plan was scheduled for submittal to Ecology and EPA in November 1991. The 216-B-63 Trench is scheduled to have a closure plan submitted to Ecology and EPA in May 1996.

The 40 single-shell tanks of the 241-B, 241-BX, and 241-BY Tank Farms will be closed under RCRA rather than seek a RCRA operating permit. The preferred closure option will be resolved through the preparation and completion of a supplemental environmental impact statement (EIS). A number of unplanned releases are associated with the tanks. In the 241-B Tank Farm these releases include UPR-200-E-108 (tank 241-B-101), UPR-200-E-127 (tank 241-B-107), UPR-200-E-128 (tank 241-B-110), UPR-200-E-129 (tank 241-B-201), and UPR-200-E-130 (tank 241-B-203). In 241-BX Tank Farm the releases are UPR-200-E-5, -131 and -132 (tank 241-BX-102) and UPR-200-E-133 (tank 241-BX-108). In 241-BY Tank Farm the associated releases are UPR-200-E-134 (tank 241-BY-103), UPR-200-E-135 (tank 241-BY-108), and UPR-200-E-116 (tank 241-BY-112). The 244-BXR Vault has been transferred to the Single-Shell Tank Program and will be closed as a part of the 241-BX Tank Farm.

The 218-E-10 Burial Ground is included in a Part B Permit Application for eight burial grounds. The permit application has been submitted to Ecology and is in the third "Notice of Deficiency" cycle.

In October 1995 the Part B permit covering B Plant Aggregate Area facilities is to be submitted to Ecology and EPA with an expected permit issue in 1997. These facilities, located within or adjacent to the 221-B Building include the following:

Waste Concentrator	treatment
Radioactive Organic Waste Solvent Tanks 1 through 7	storage
Storage Area	storage
Waste Piles	storage

The four HWSAs, 226-B, 2703-E, 2704-E, and 2715-EA, perform as temporary waste accumulators and, as such, are not required to have a RCRA Part B permit.

2.7 INTERACTIONS WITH OTHER HANFORD PROGRAMS

In addition to RCRA, there are several other ongoing programs that affect buildings and waste management units in the B Plant Aggregate Area. These programs include: the Hanford Surplus Facilities Program, the Radiation Area Remedial Action Program, the Hanford Site Single-Shell Tank Program, and the Defense Waste Management Program.

The Hanford Surplus Facilities Program is responsible for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities at the Hanford Site. There are four B Plant Aggregate Area facilities covered under this program. These facilities are the 224-B Plutonium Concentration Building, the 242-B Evaporator, the 241-B-361 Settling Tank, and the 270-E Condensate Neutralization Tank.

The Radiation Area Remedial Action (RARA) Program is conducted as part of the Surplus Facilities Program. The RARA is responsible for the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned releases at the Hanford Site. A major concern associated with these requirements is the management and control of surface soil contamination. All of the controlled access surface radiation zones and the cribs with collapse potential in the B Plant Aggregate Area are covered by this program.

The Hanford Site Single-Shell Tank Program covers near-term waste management activities to ensure safe interim storage of waste in the tanks. It also addresses the environmental restoration activities to close the six single-shell tank operable units, including the 241-B, 241-BX, and 241-BY Tank Farms. The primary regulatory drivers of this program are the Tri-Party Agreement and RCRA.

The Defense Waste Management Program is responsible for all actively operating waste management units in the B Plant Aggregate Area. These facilities include the waste management units listed below and all high-level waste process lines and their associated diversion boxes.

Operable Unit	Waste Management Unit	Type
200-BP-5	216-B-59	retention basin
200-BP-6	226-B HWSA	staging area
	241-ER-152	diversion box
	2607-E3	septic tank
	2607-E4	septic tank
200-BP-7	2607-EB	septic tank
200-BP-8	207-B	retention basin
	216-B-63	trench
	2607-E9	septic tank
200-BP-9	216-B-55	crib
	216-B-62	crib
	241-ER-151	diversion box
	241-ER-311	catch tank
200-BP-10	218-E-10	burial ground

Operable Unit	Waste Management Unit	Type
200-BP-11	216-B-3	pond
	216-B-3A	pond
	216-B-3B	pond
	216-B-3C	pond
	216-B-3-3	ditch
200-SS-1	2703-E HWSA	staging area
	2704-E HWSA	staging area
	2715-EA HWSA	staging area
	2607-E1, -E2, -E8, -E11, -EK, -EM, -EN, -EO, -EP, -EQ, -Er, -GF	septic tanks
	200-E Powerhouse Ash Pit	

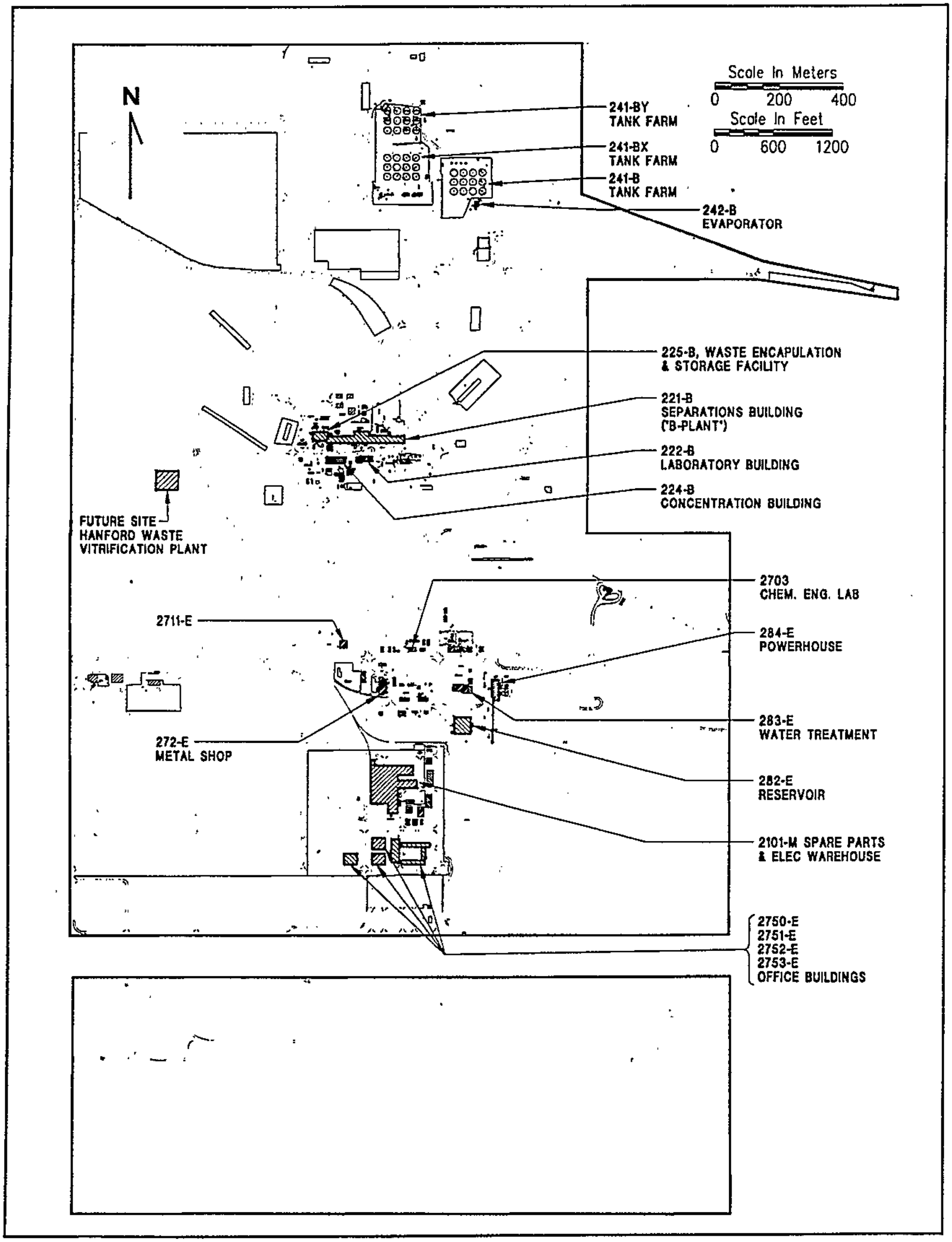


Figure 2-1. Location of Plants, Buildings, and Storage Units: Western Portion Operable Units.

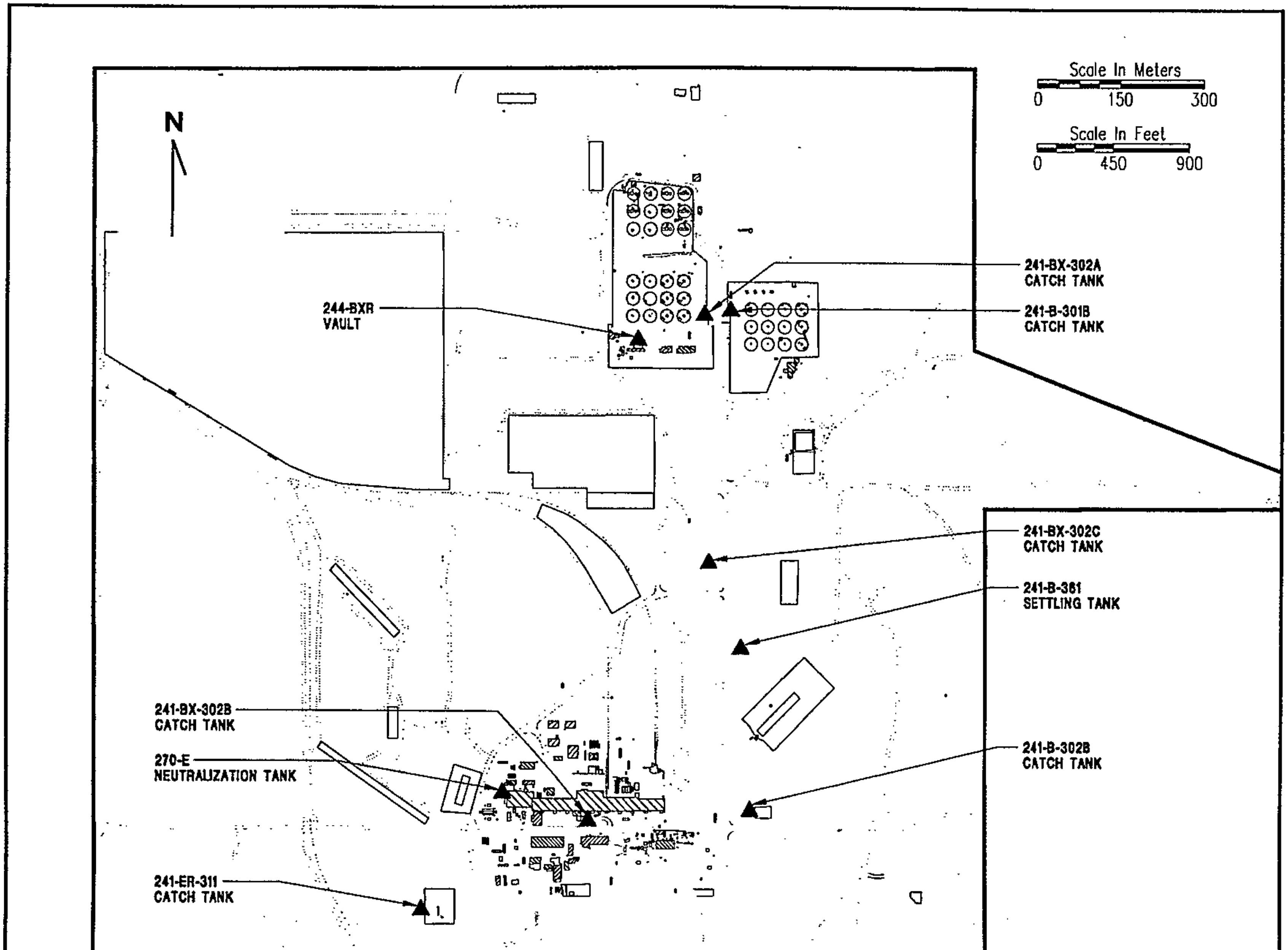


Figure 2-2. Location of Tanks and Vaults: Western Portion Operable Units.

T920106B

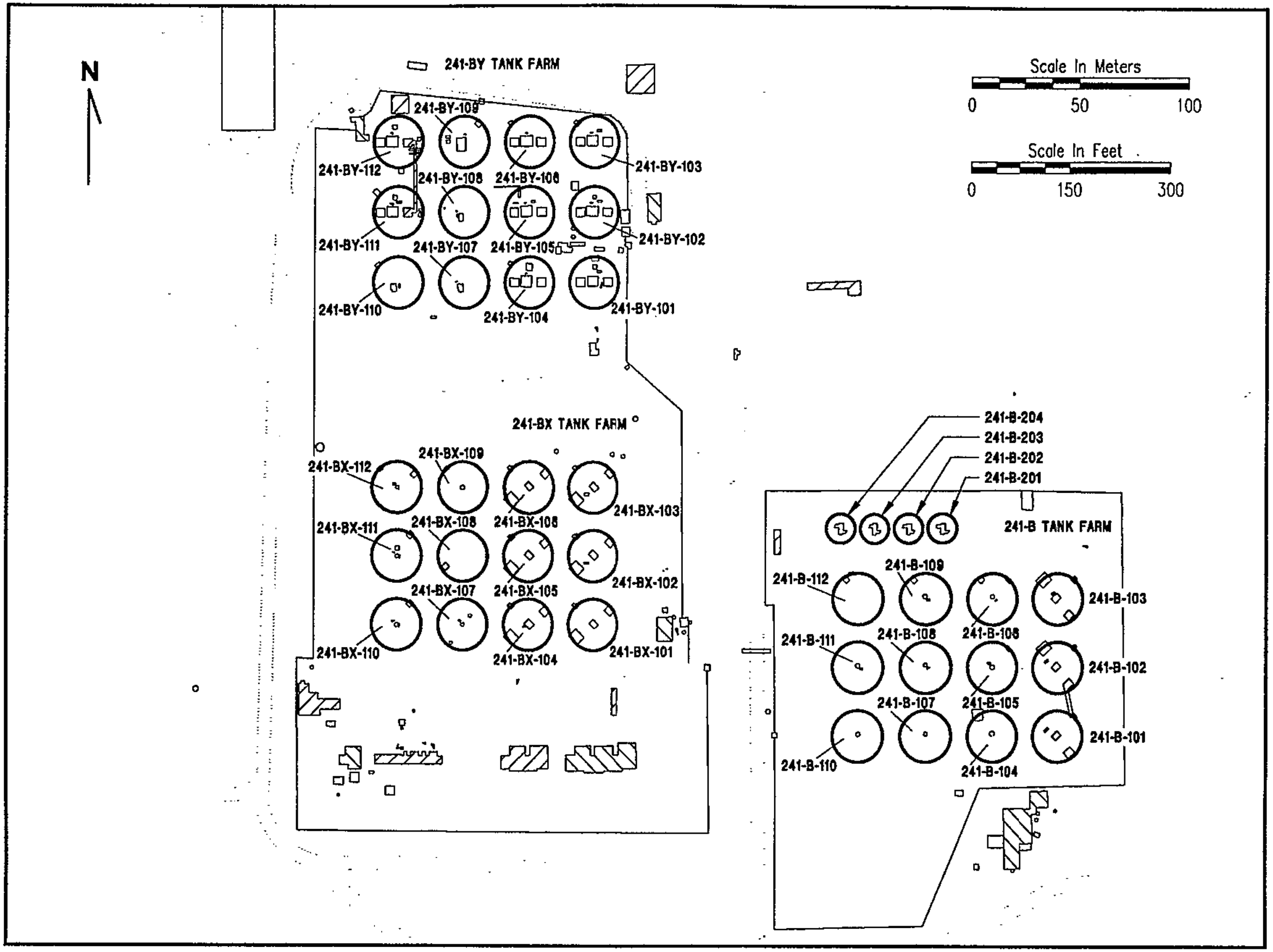


Figure 2-3. Location of Tanks and Vaults: Tank Farms.

T920107B

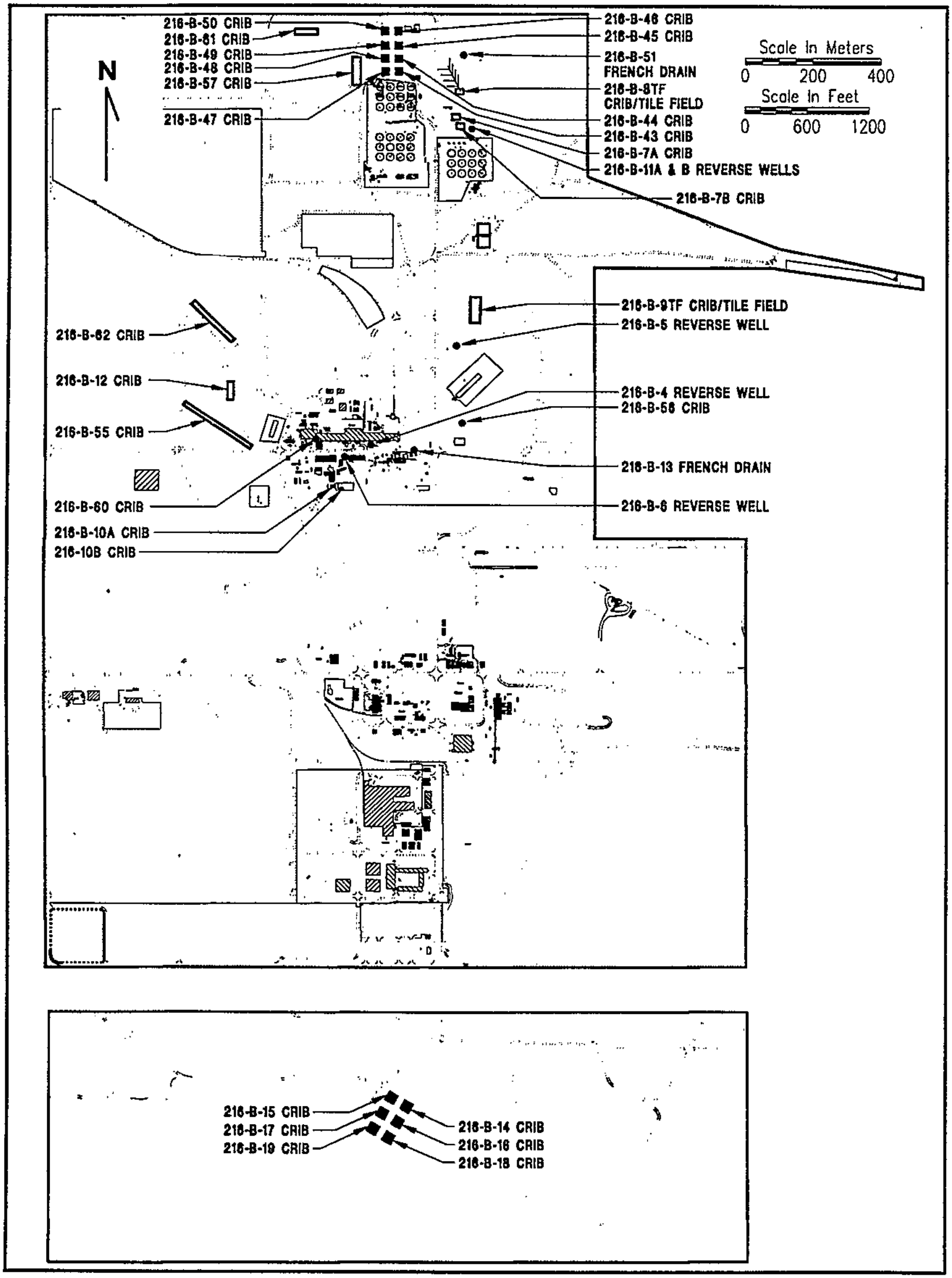


Figure 2-4. Location of Cribs, Drains, and Reverse Wells: Western Portion Operable Units. T920108B

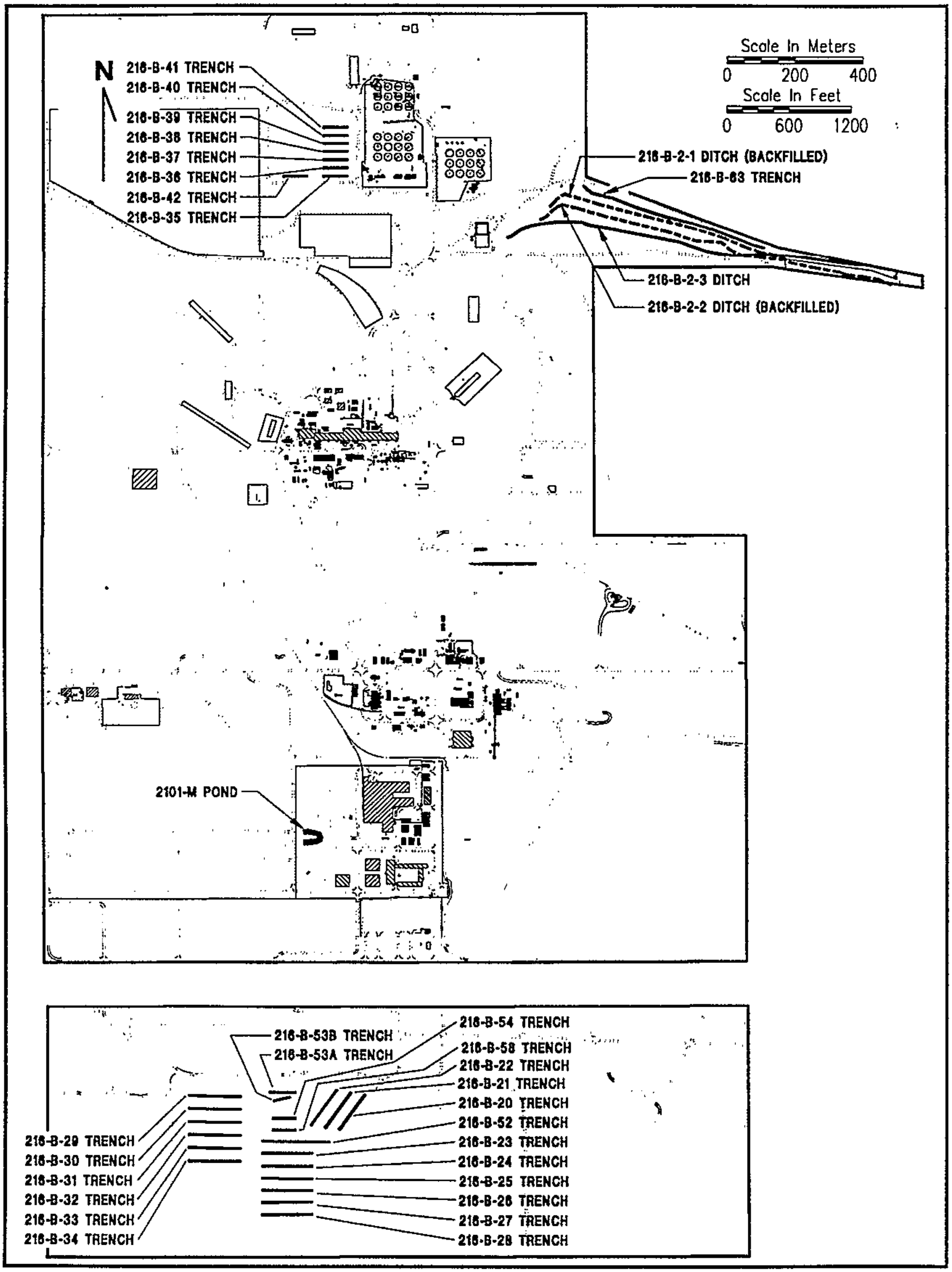


Figure 2-5. Location of Ponds, Ditches, and Trenches: Western Portion Operable Units.

T920109B

9 2 1 2 5 0 1 5 7

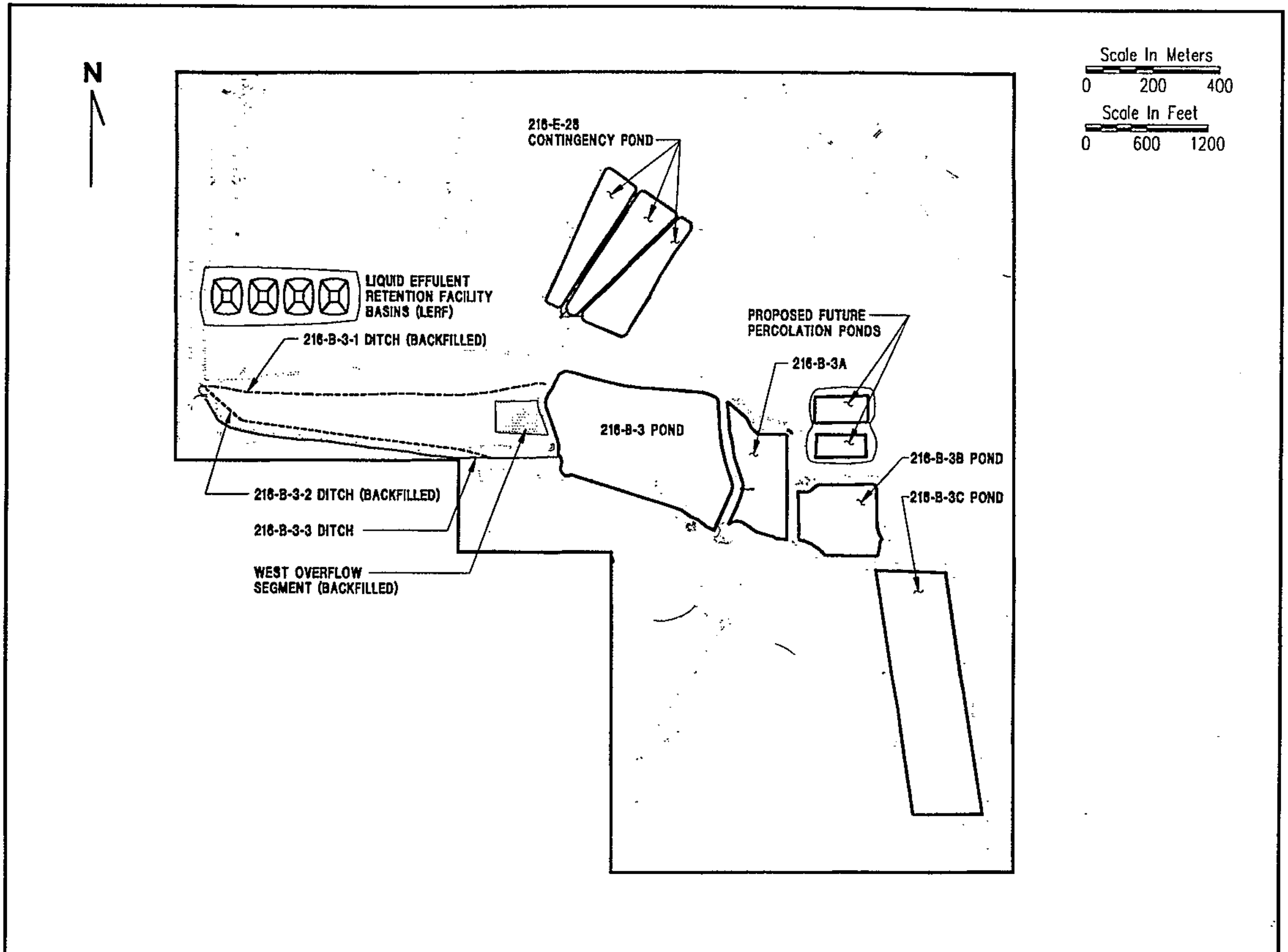
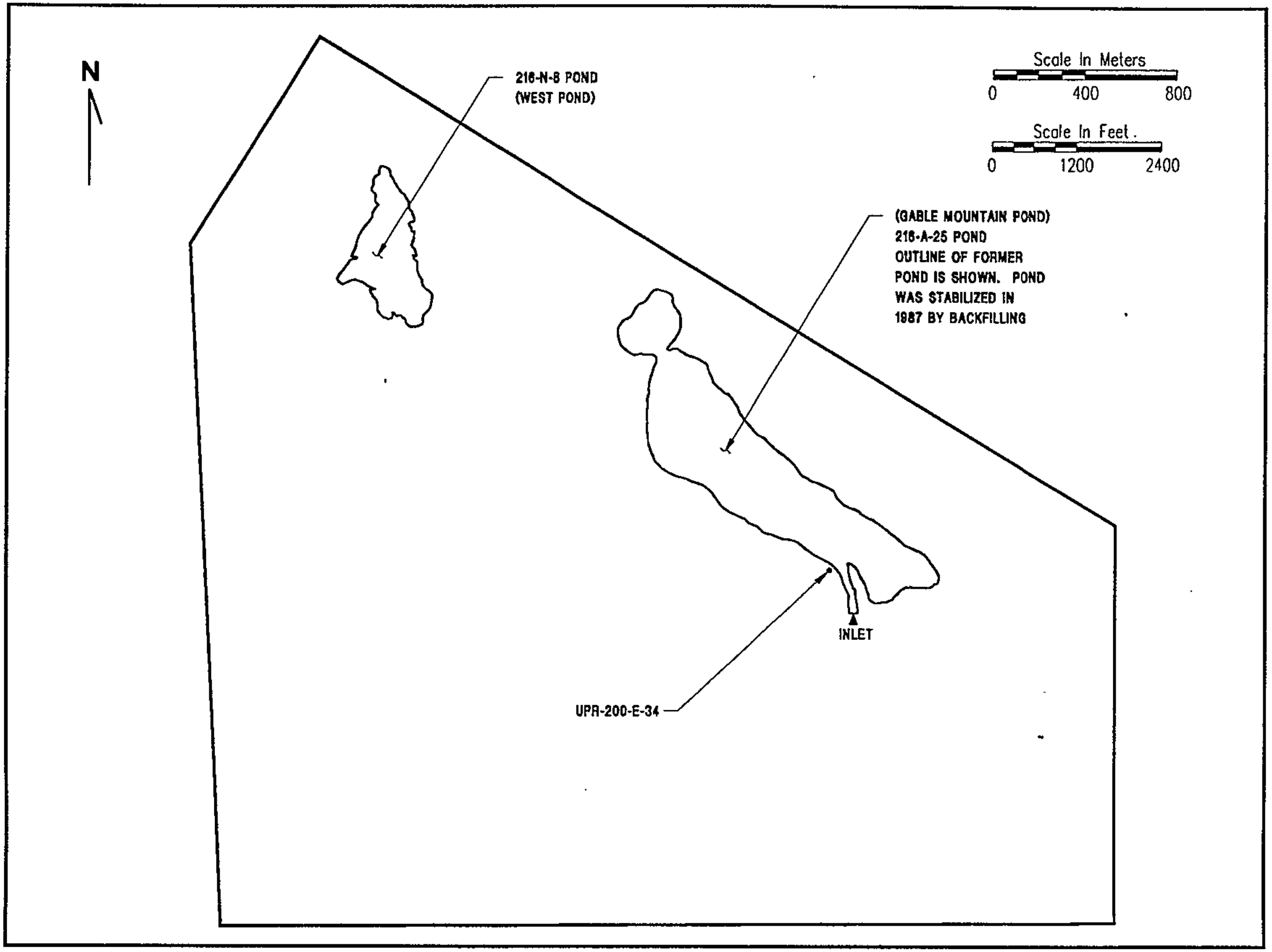


Figure 2-6. Location of Ponds, Ditches, and Trenches: 200-BP-11 Operable Unit.

T920115B



T920117B

Figure 2-7. Location of Ponds and Unplanned Releases: 200-IU-6 Operable Unit.

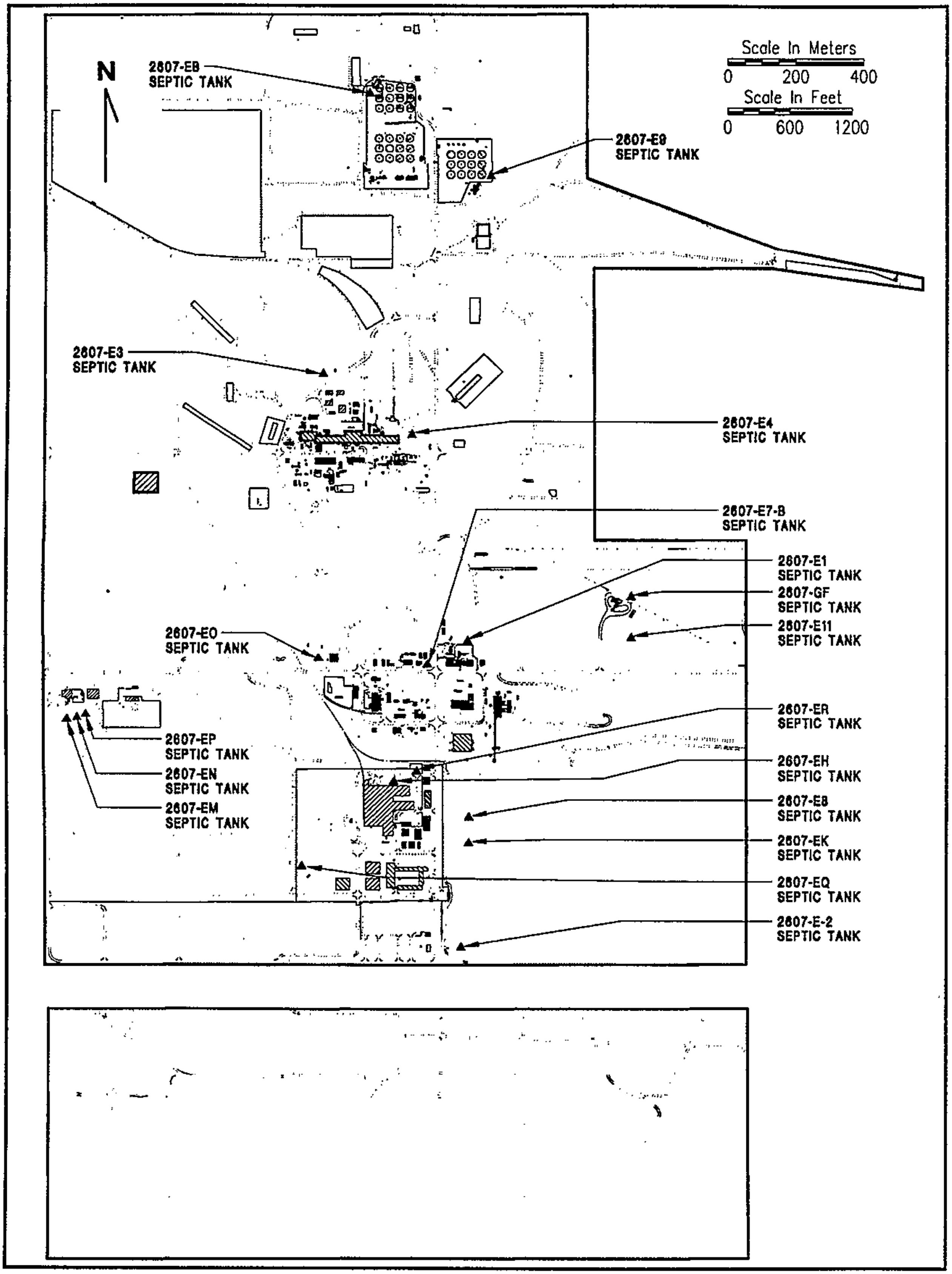


Figure 2-8. Location of Septic Tanks and Drain Fields: Western Portion Operable Units.

T920110B

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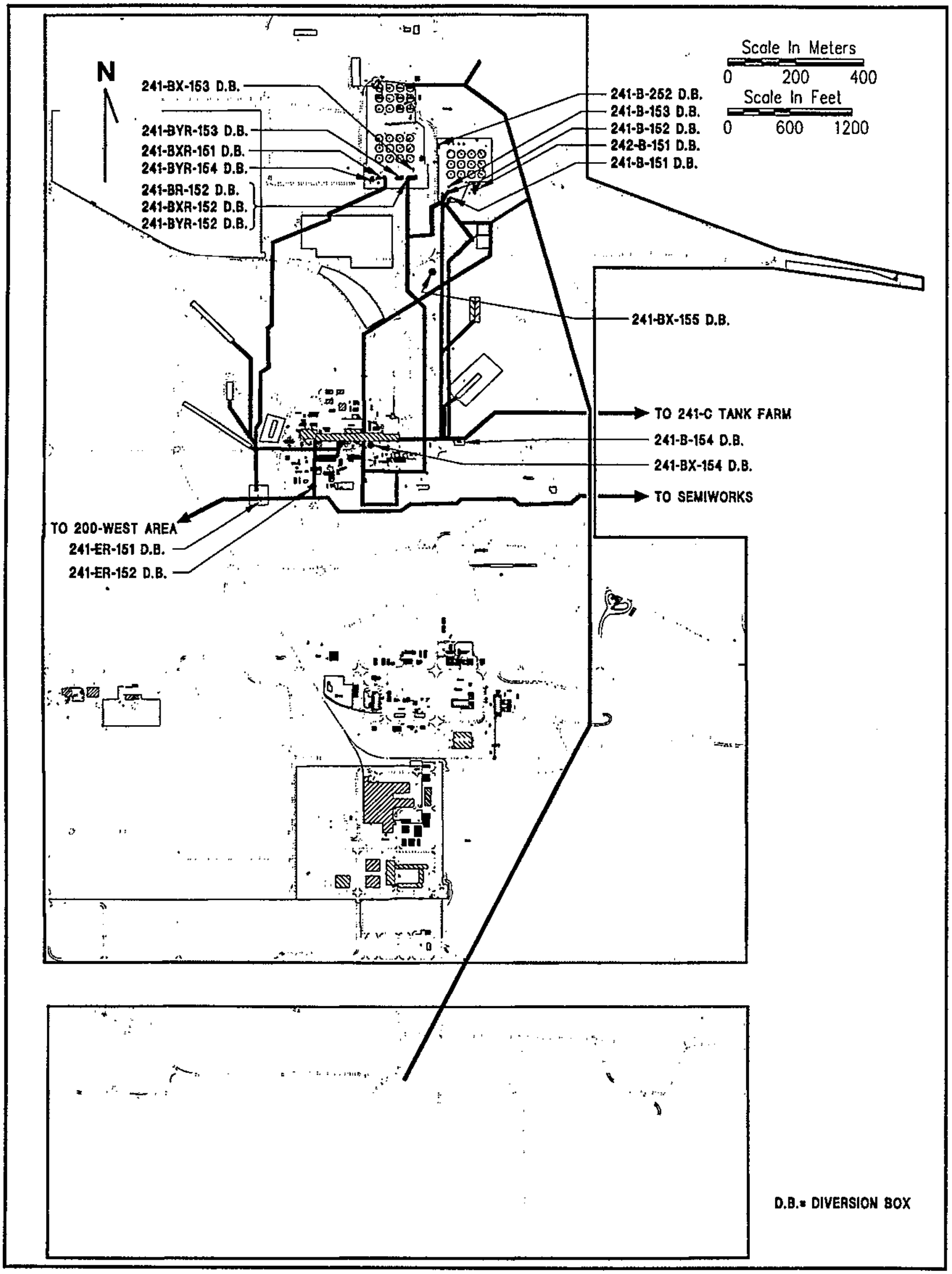


Figure 2-9. Location of Transfer Facilities, Diversion Boxes, and Pipelines: Western Portion Operable Units.

"920111B

9 2 1 2 ? 0 1 7 1

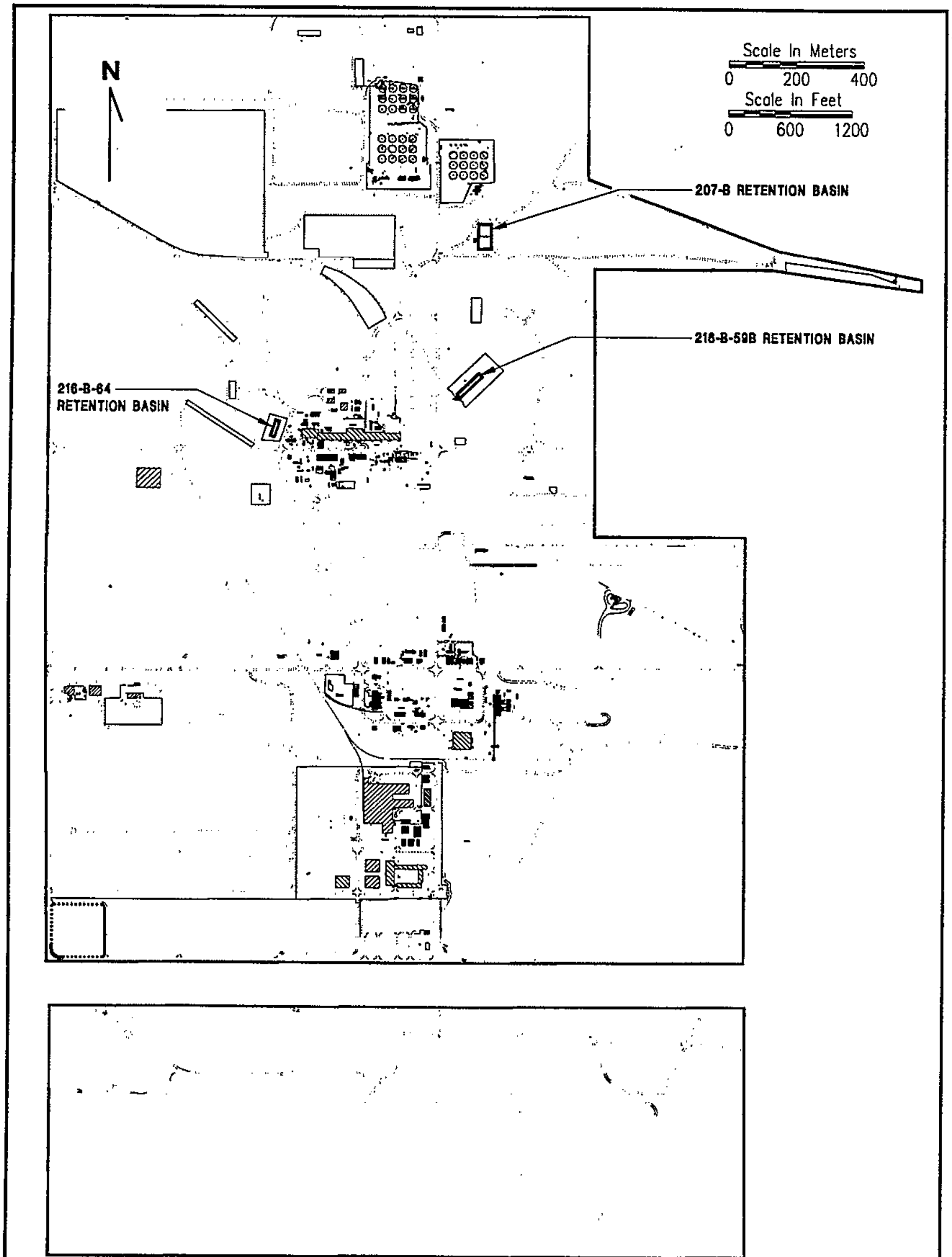


Figure 2-10. Location of Basins: Western Portion Operable Units.

T920112B

9 2 1 2 3 1 1 7 2

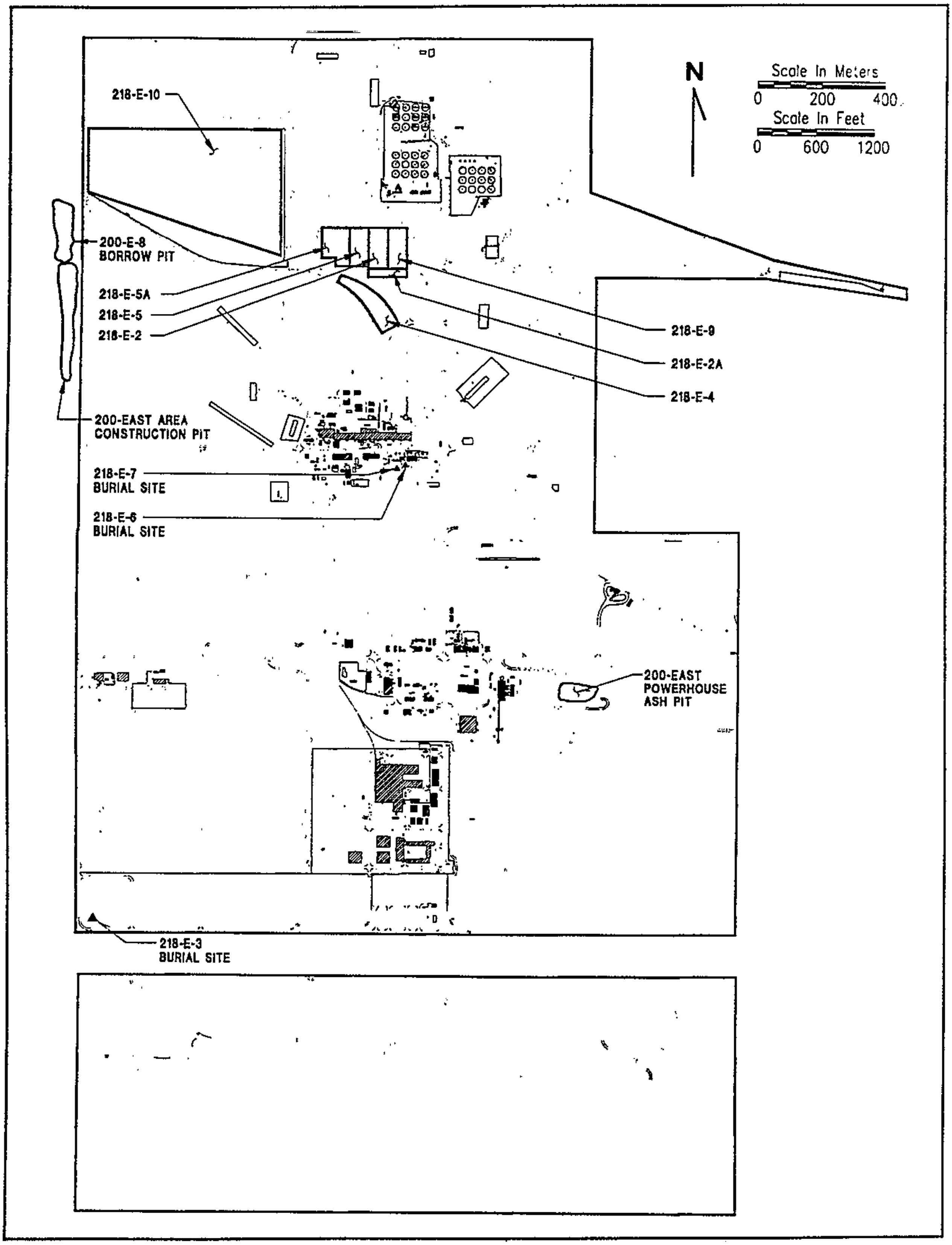


Figure 2-11. Location of Burial Sites: Western Portion Operable Units.

9 2 1 2 . 2 1 7 3

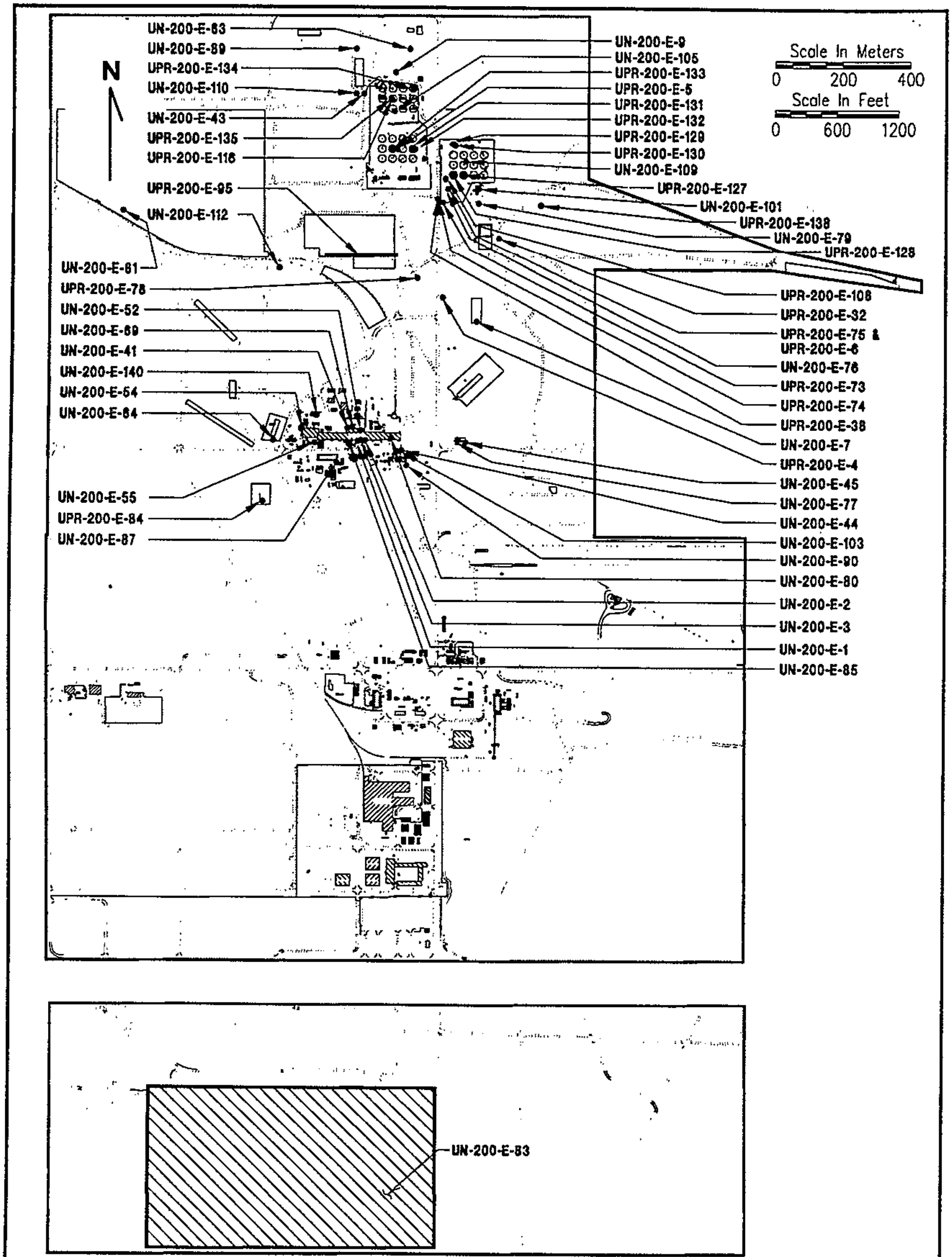
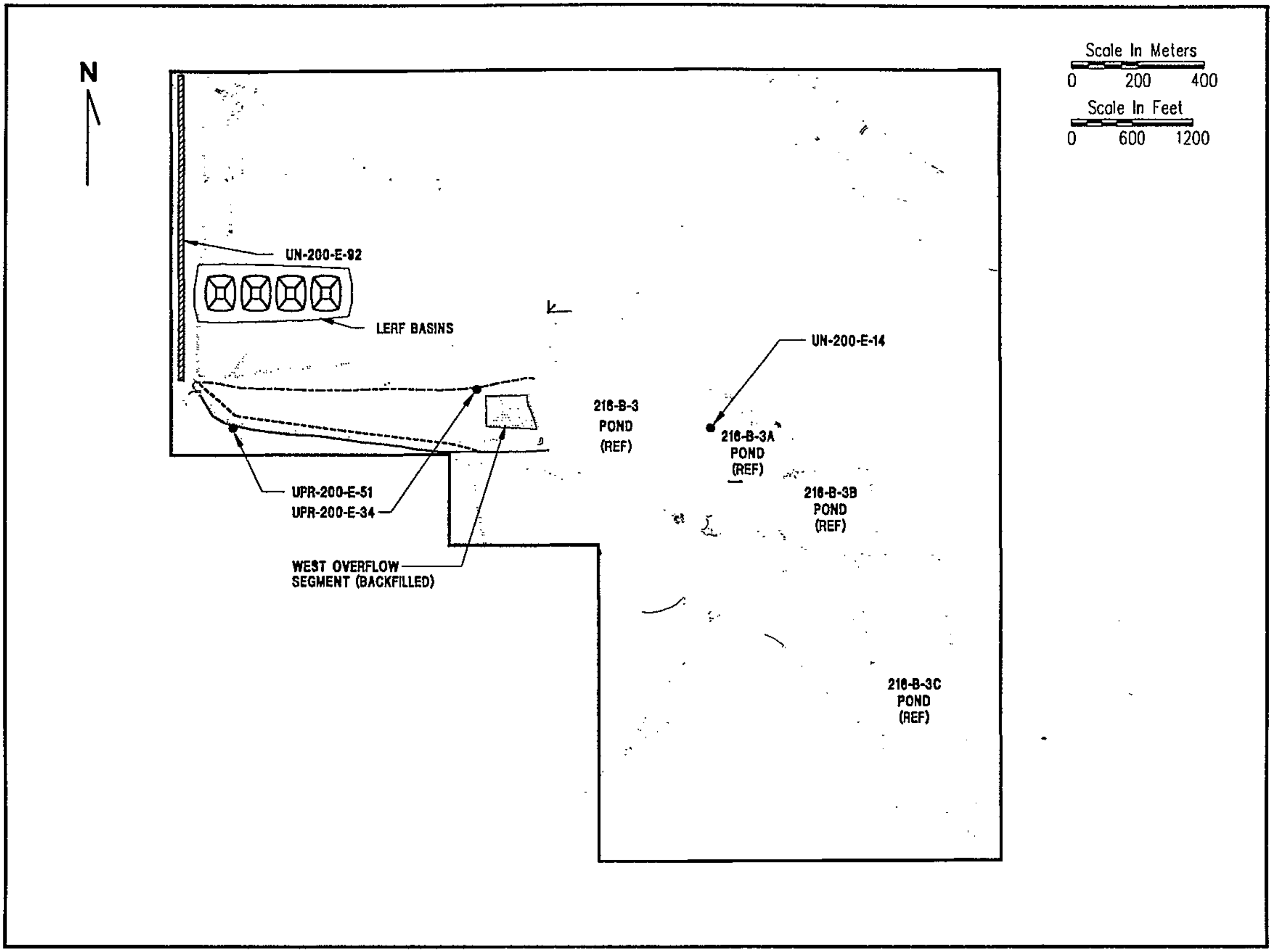


Figure 2-12. Location of Unplanned Releases: Western Portion Operable Units. T920114B



T920116B

Figure 2-13. Location of Unplanned Releases: 200-BP-11 Operable Unit.

9 2 1 2 5 5 3 1 7 6

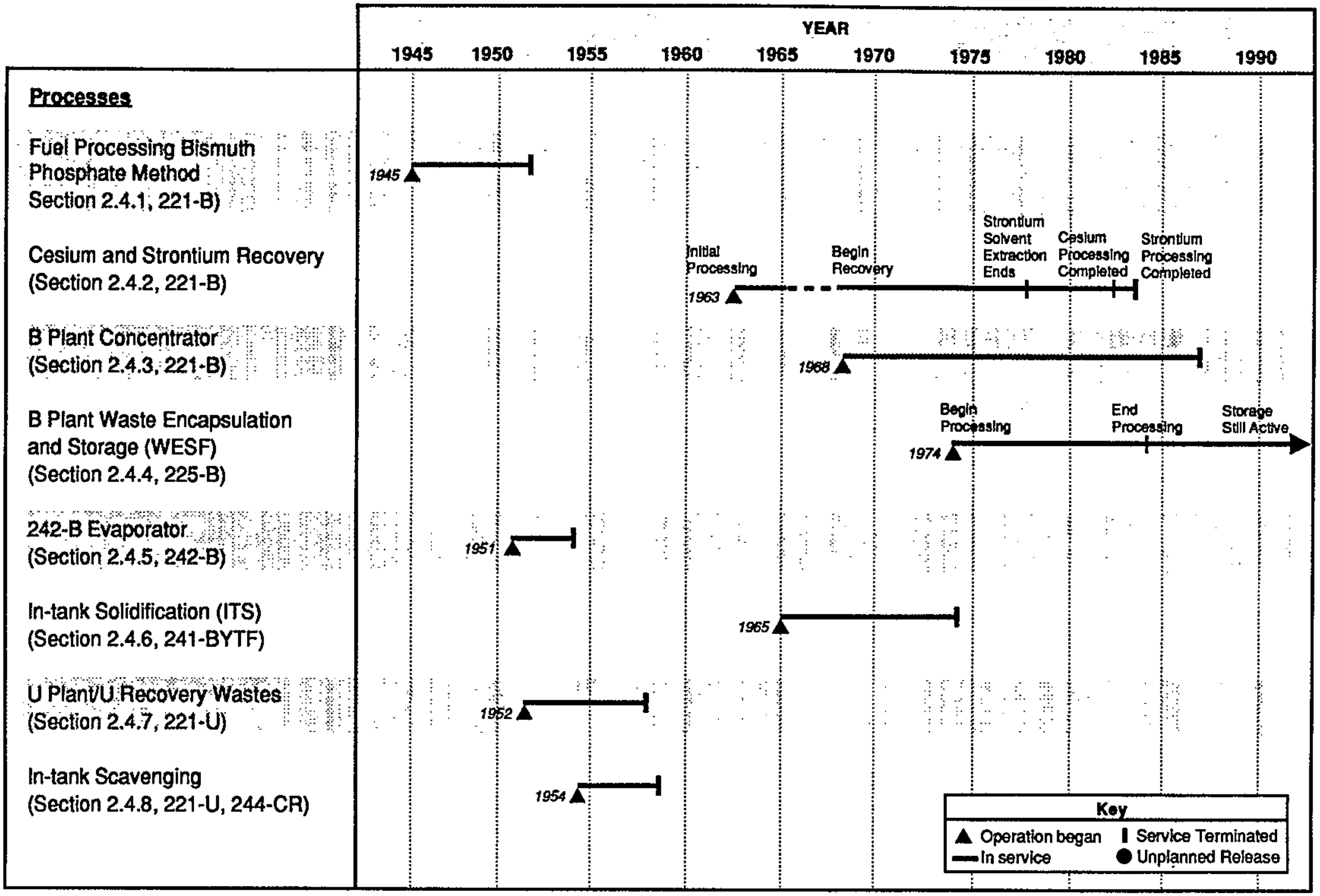


Figure 2-14. Process History of B Plant Aggregate Area.

9 2 1 2 5 5 0 1 7 7

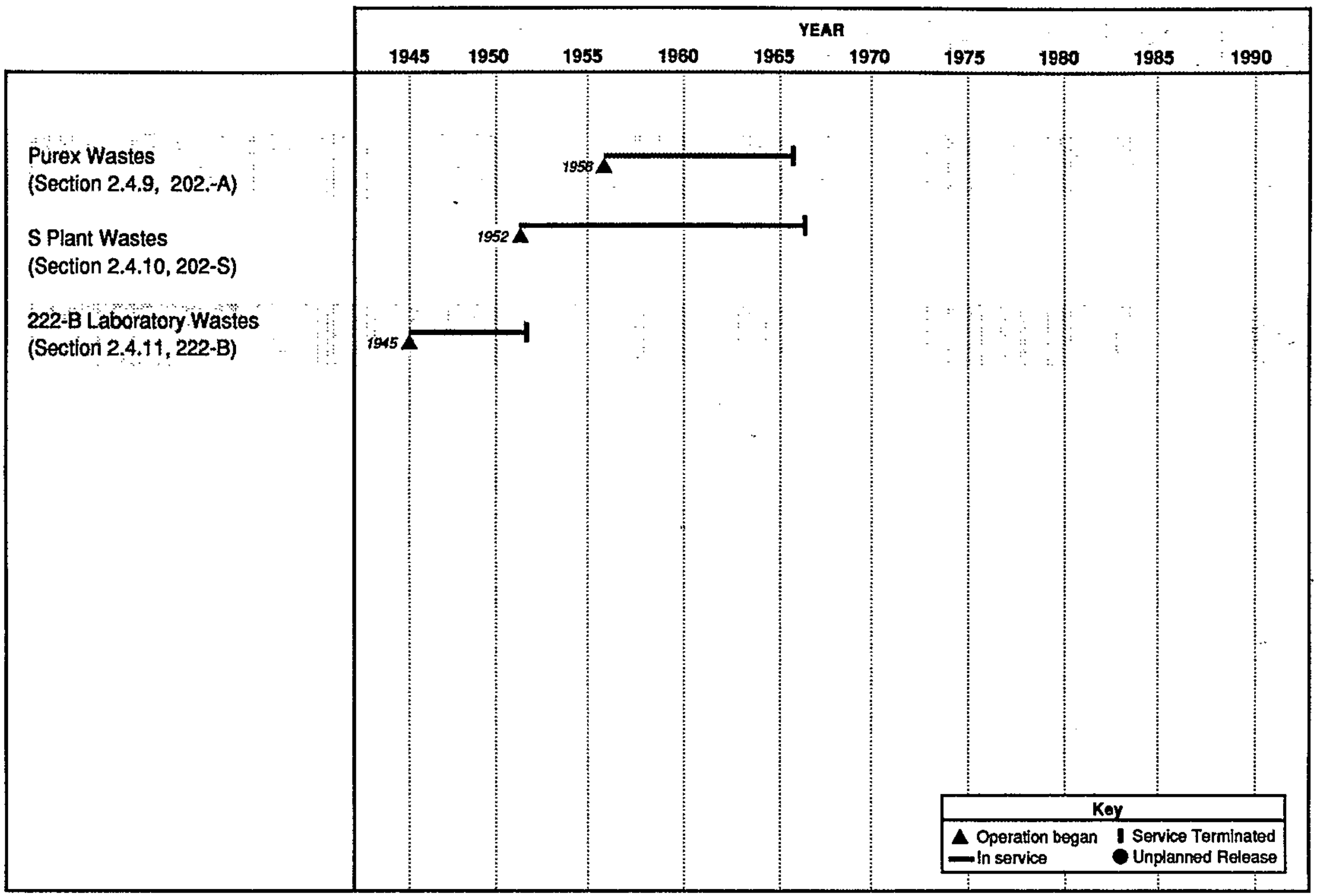


Figure 2-14. Process History of B Plant Aggregate Area.

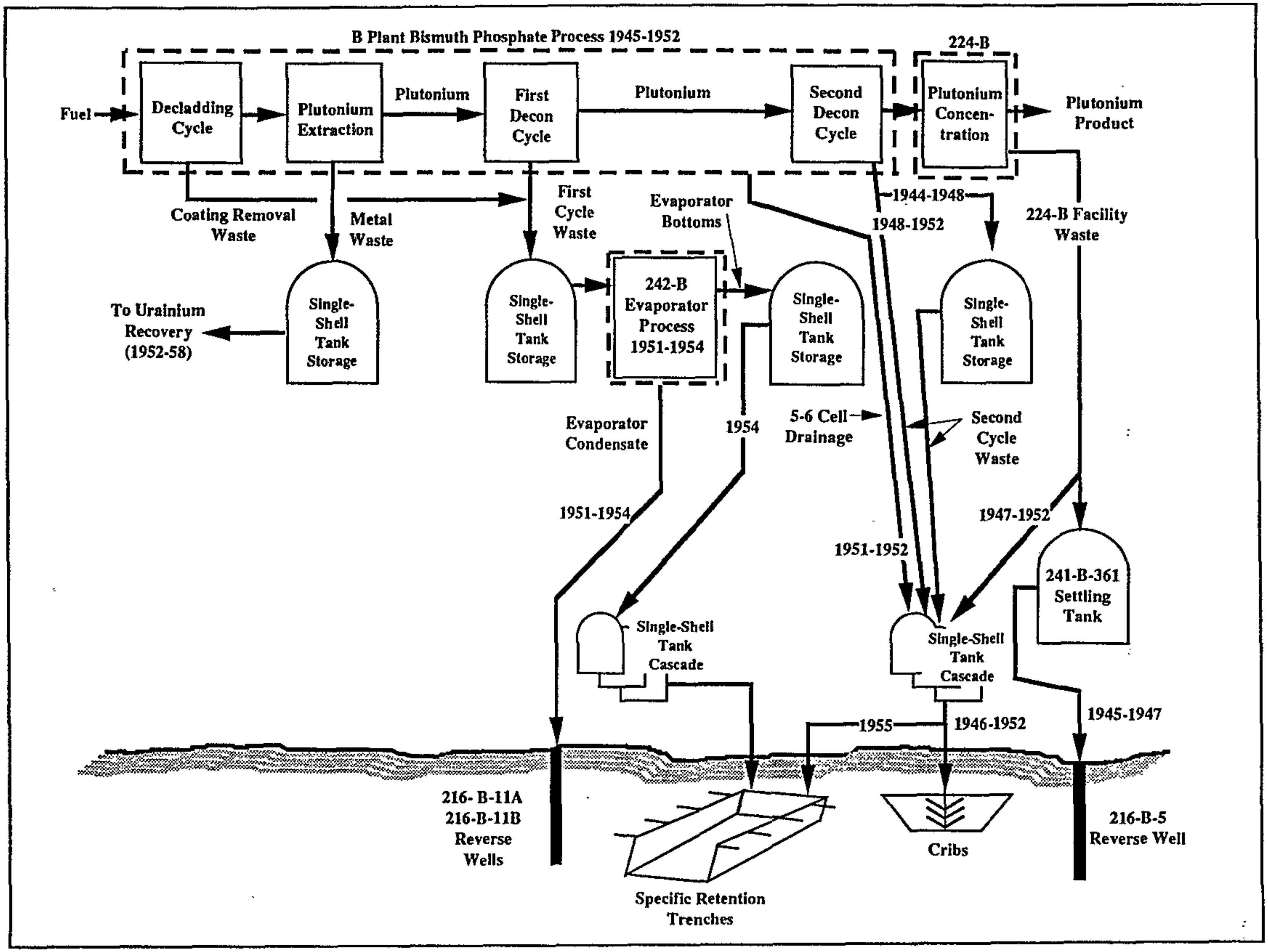


Figure 2-15. Fuel Separations Processing at B Plant (1945-1954).

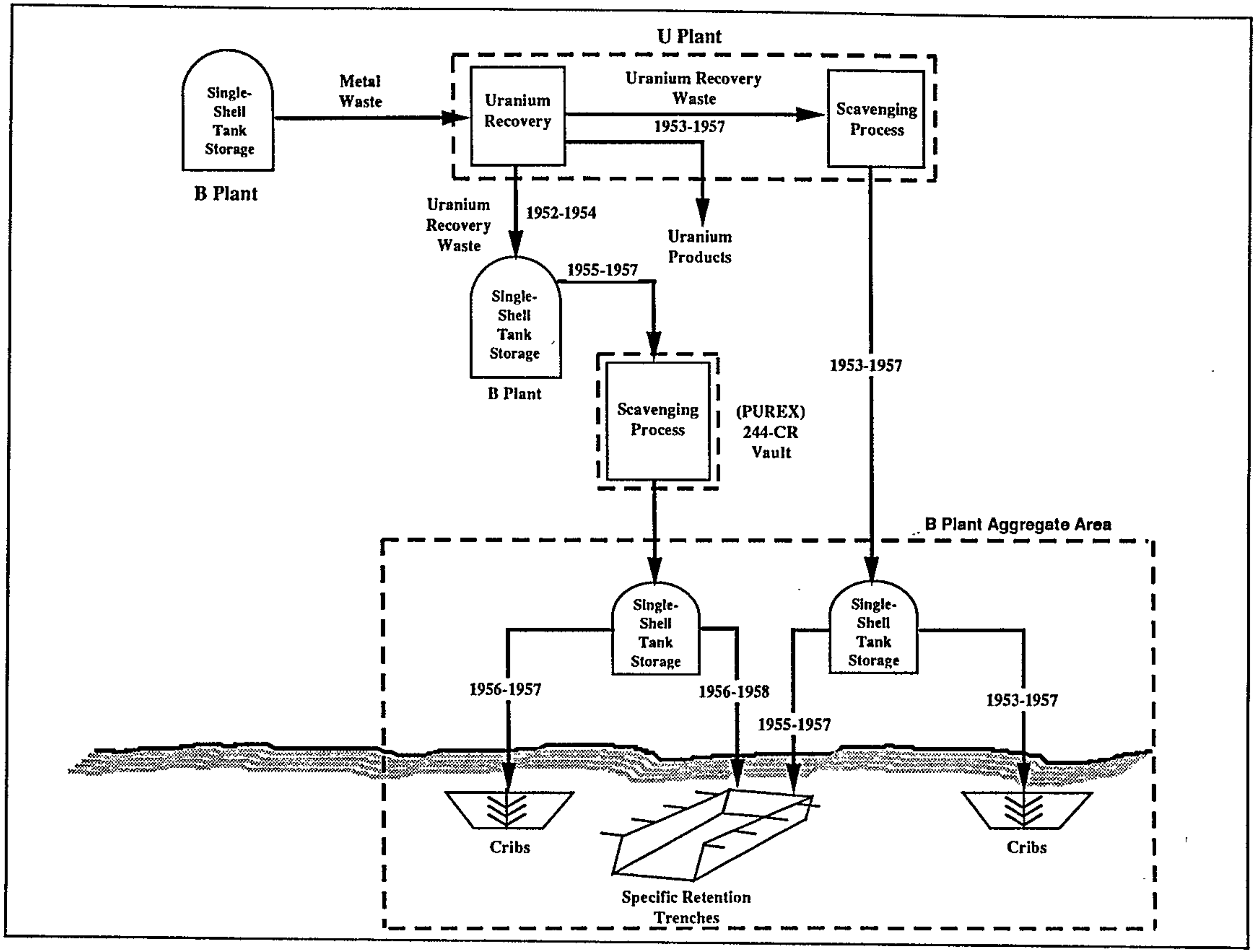


Figure 2-16. B Plant Uranium Recovery Processing and Tank Scavenging Processes.

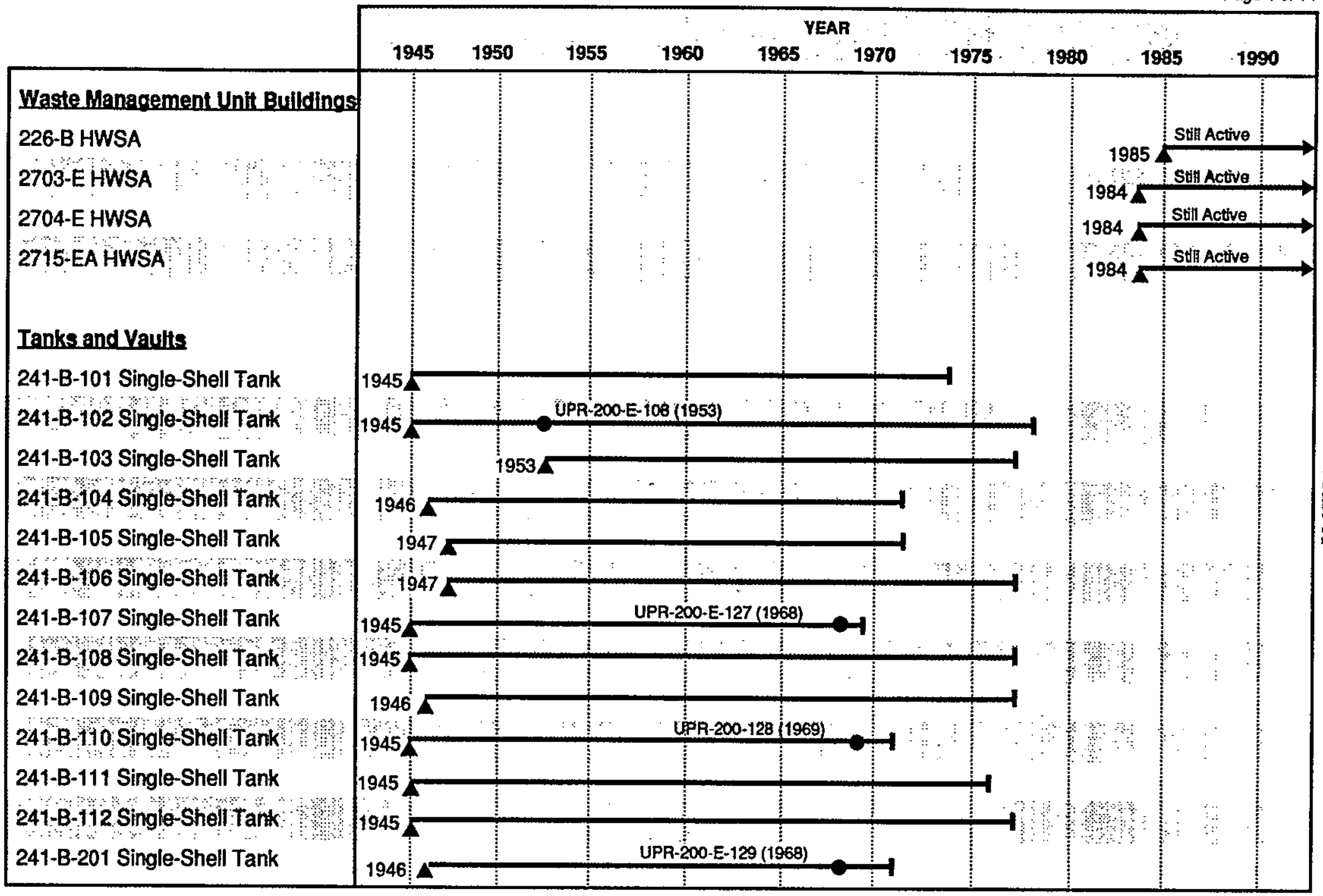
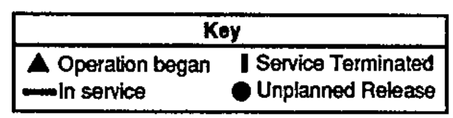


Figure 2-17. Waste Management Unit Operational History.



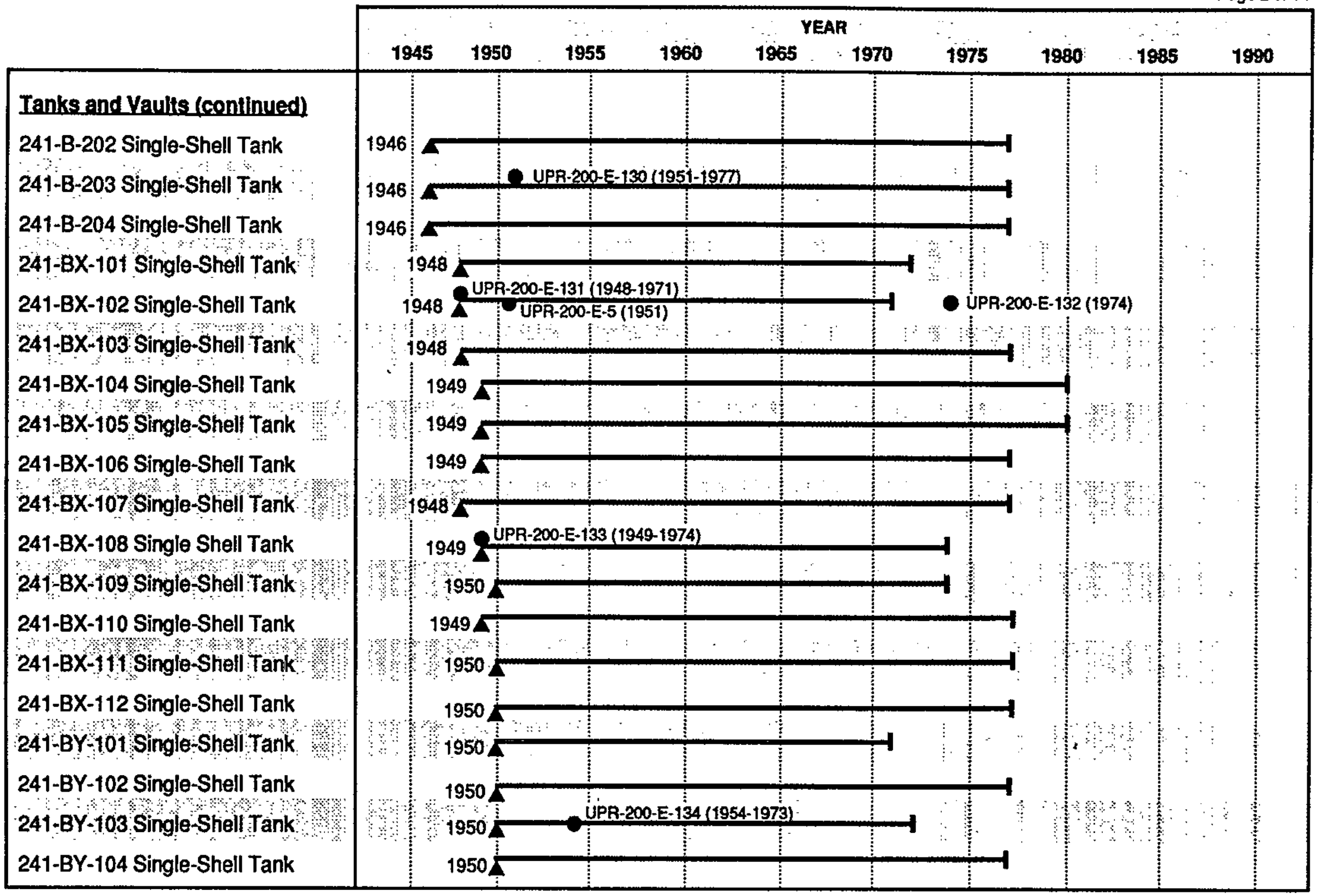
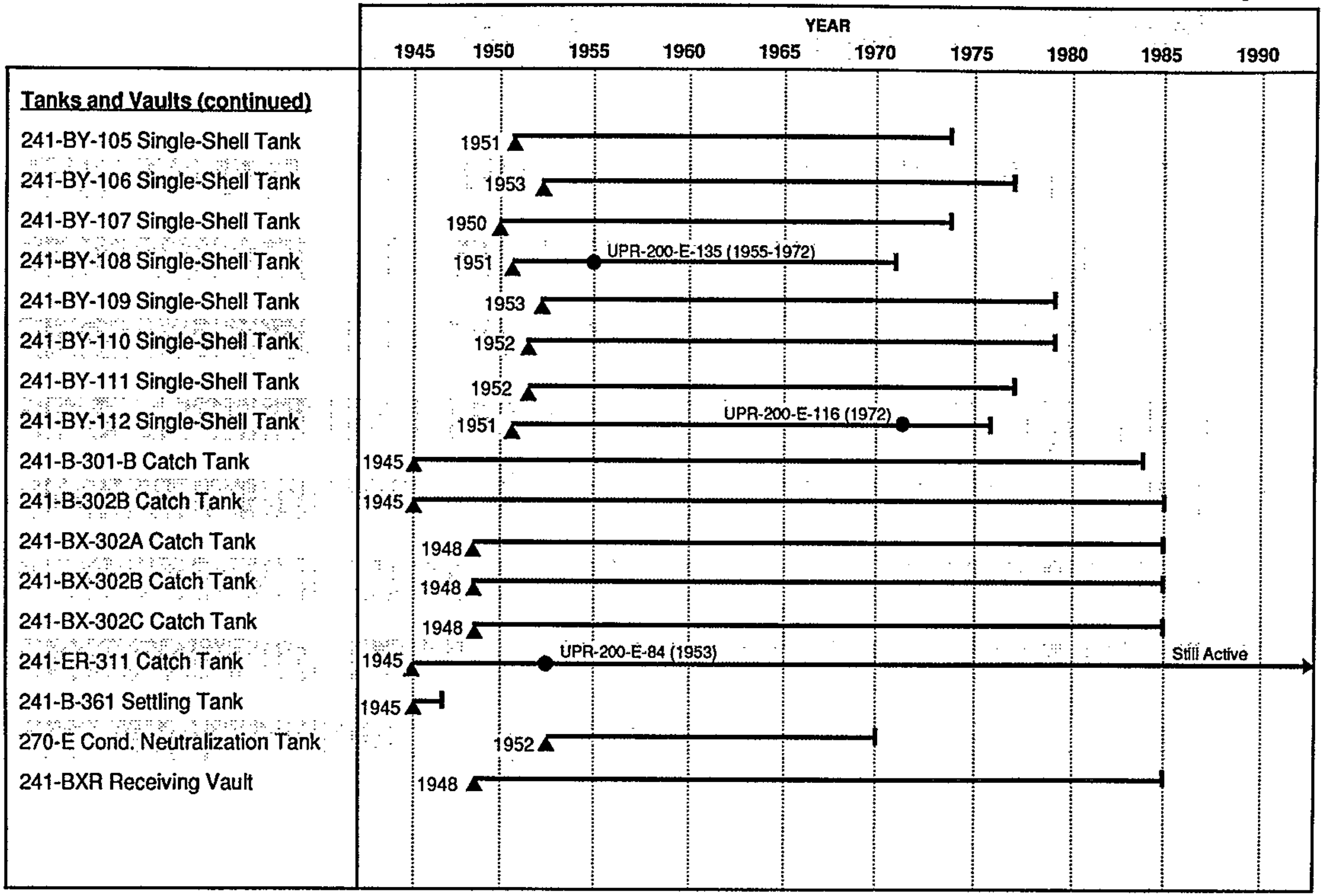


Figure 2-17. Waste Management Operational History. (continued)



Key
▲ Operation began
I Service Terminated
— In service
● Unplanned Release

Figure 2-17. Waste Management Operational History. (continued)

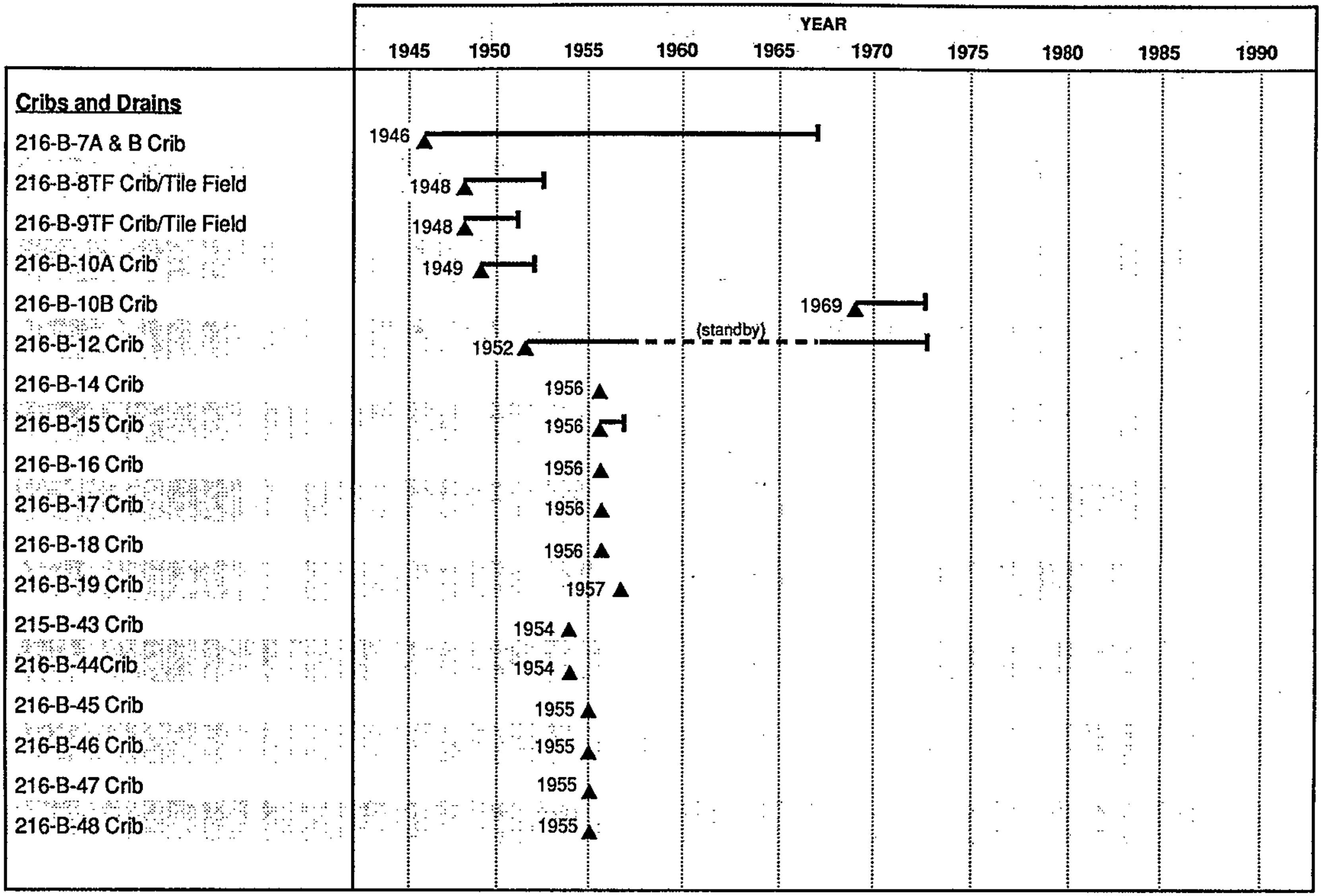


Figure 2-17. Waste Management Operational History. (continued)

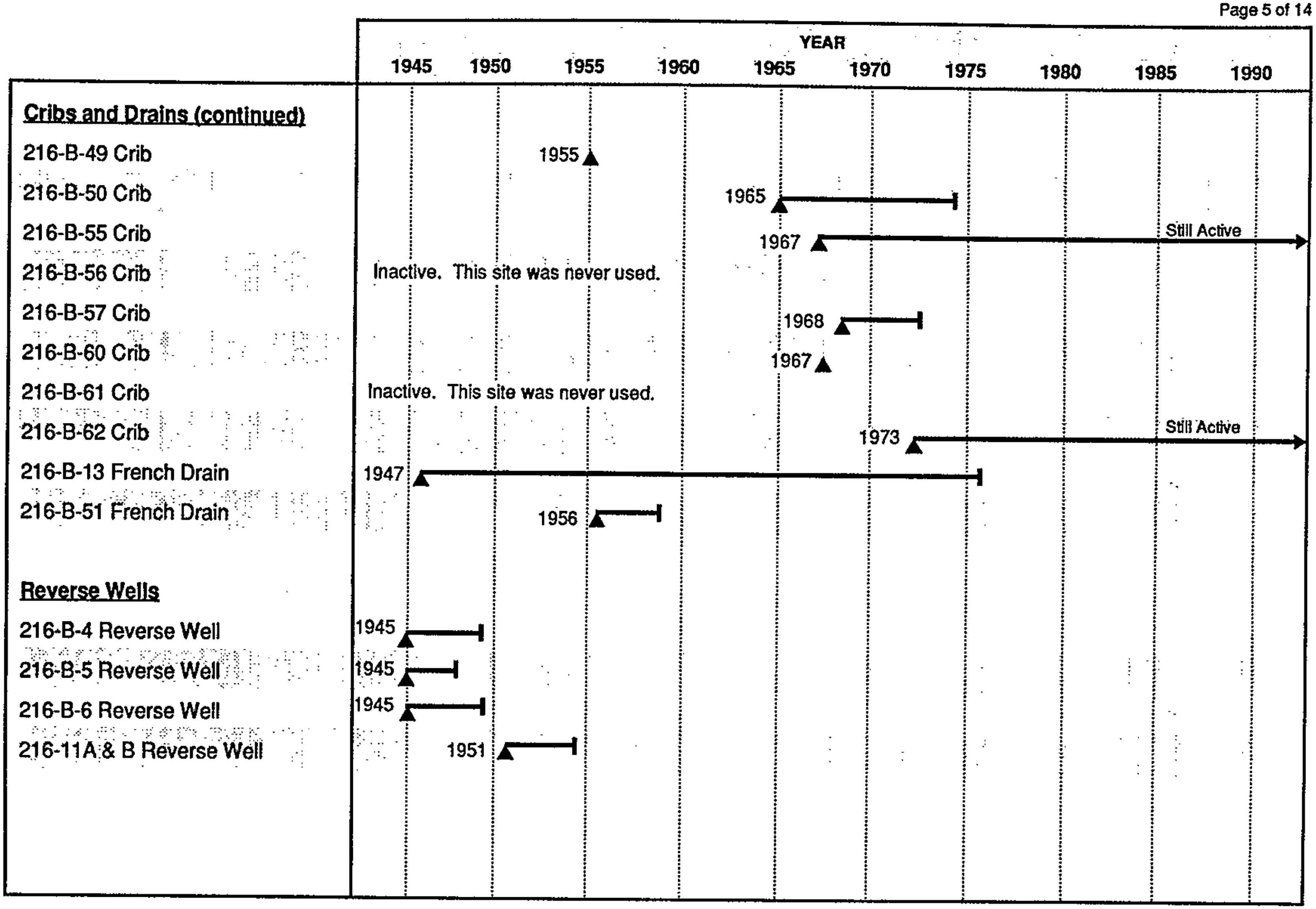
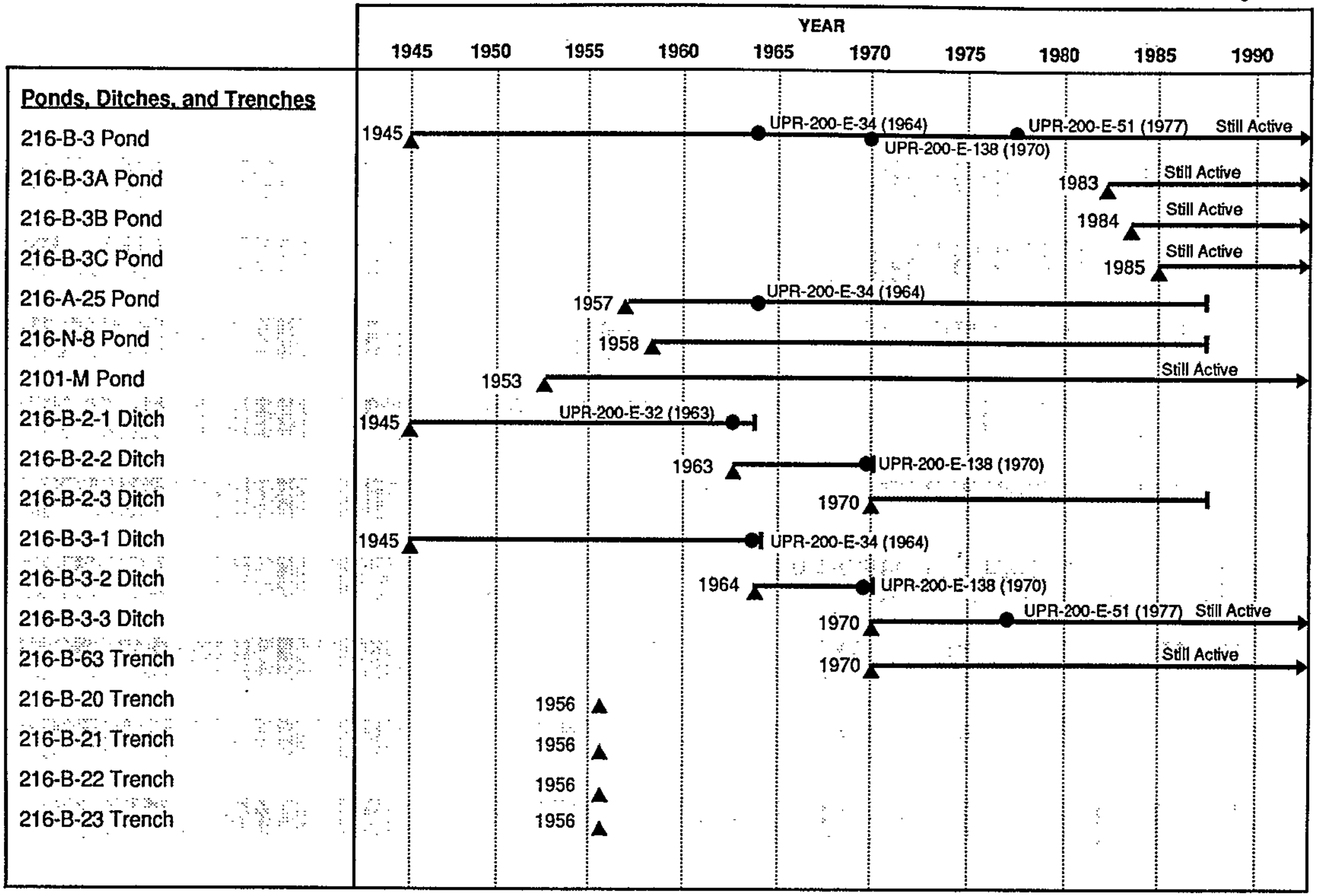


Figure 2-17. Waste Management Operational History. (continued)

Key	
▲ Operation began	▌Service Terminated
— In service	● Unplanned Release



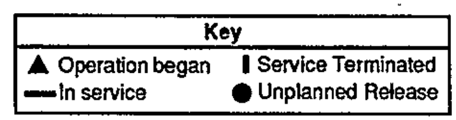


Figure 2-17. Waste Management Operational History. (continued)

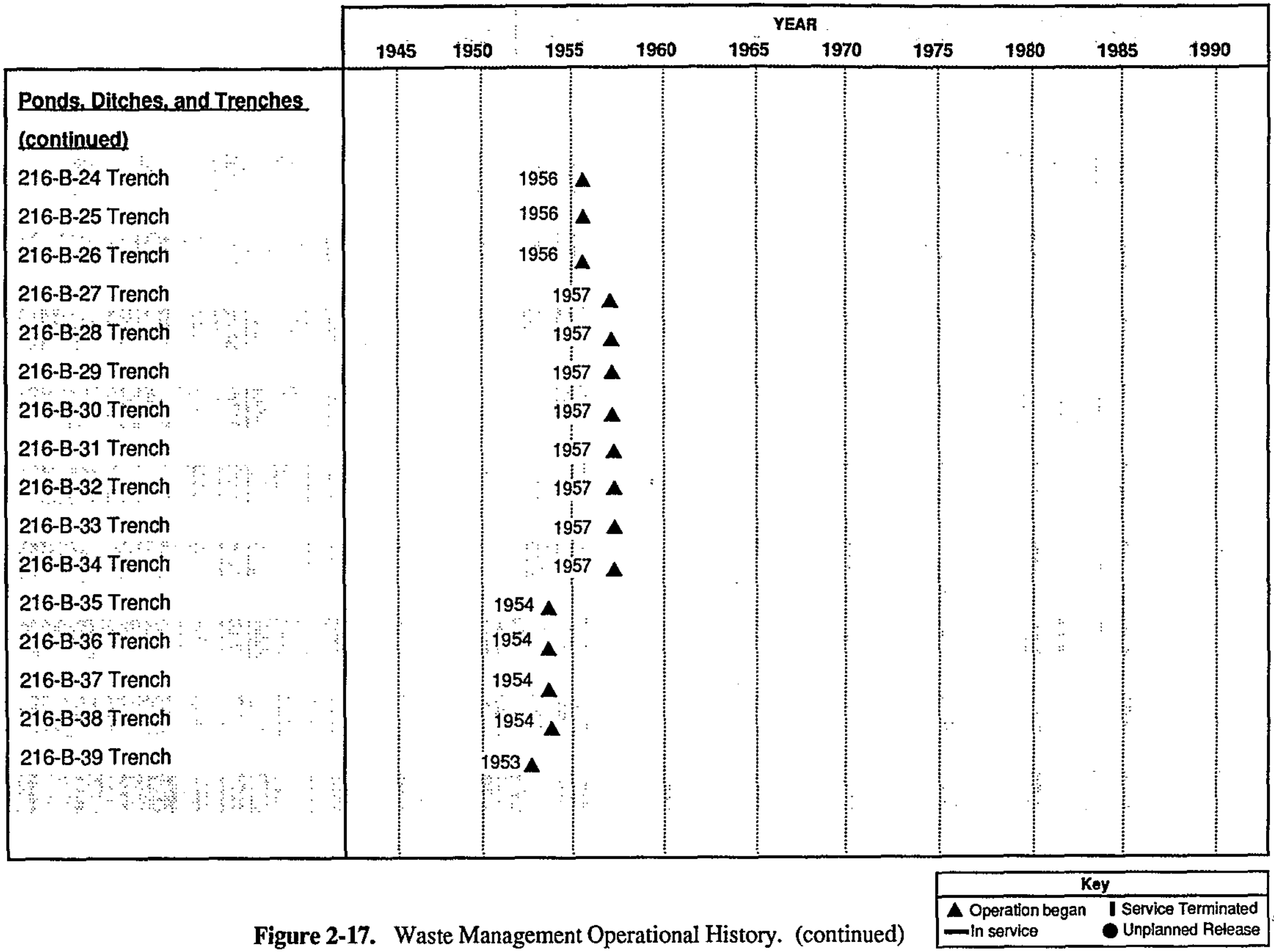


Figure 2-17. Waste Management Operational History. (continued)

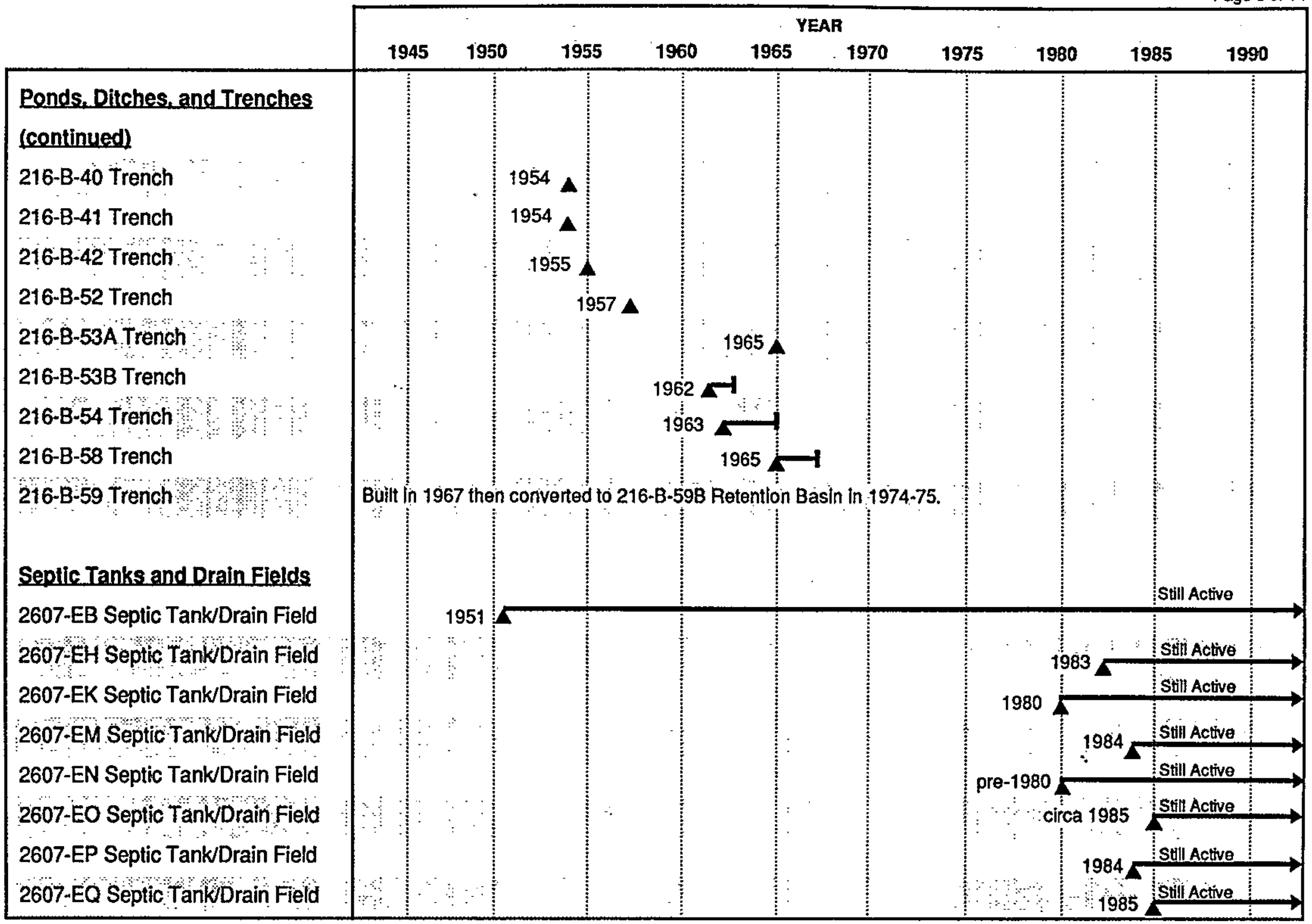


Figure 2-17. Waste Management Operational History. (continued)

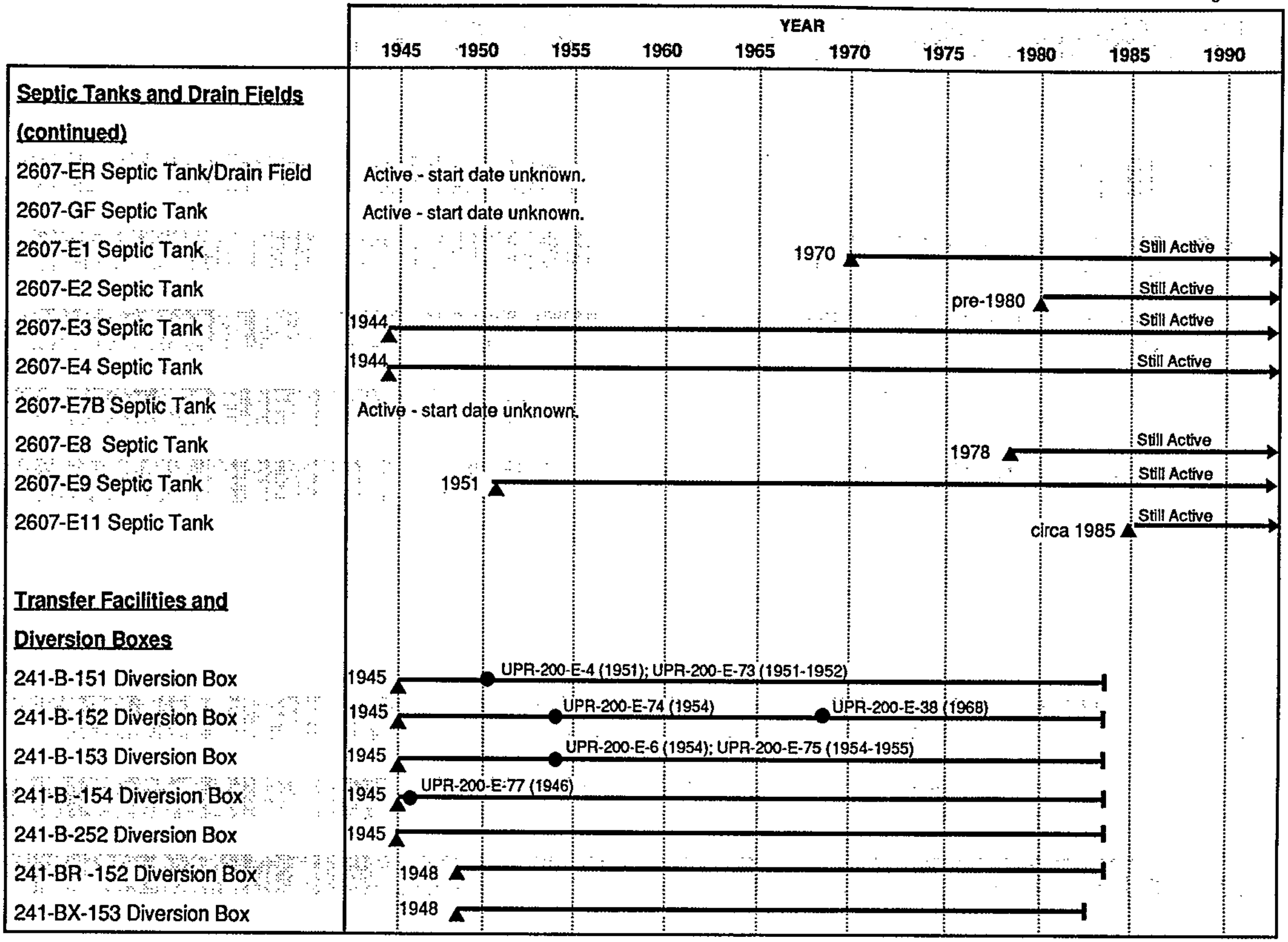
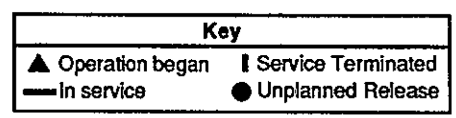


Figure 2-17. Waste Management Operational History. (continued)



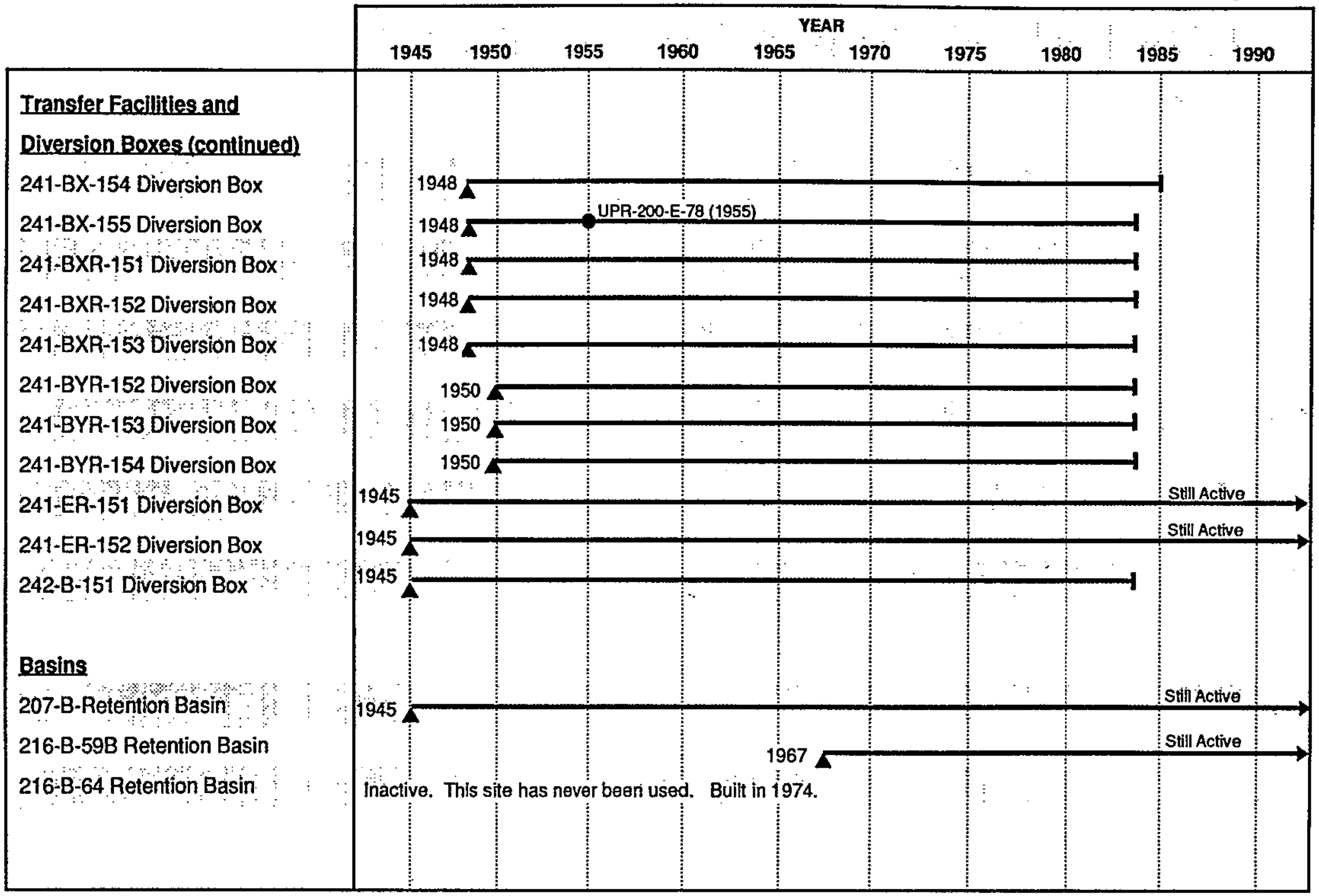


Figure 2-17. Waste Management Operational History. (continued)

Key	
▲ Operation began	❙ Service Terminated
— In service	● Unplanned Release

9 2 1 2 . . 5 0 1 0 0

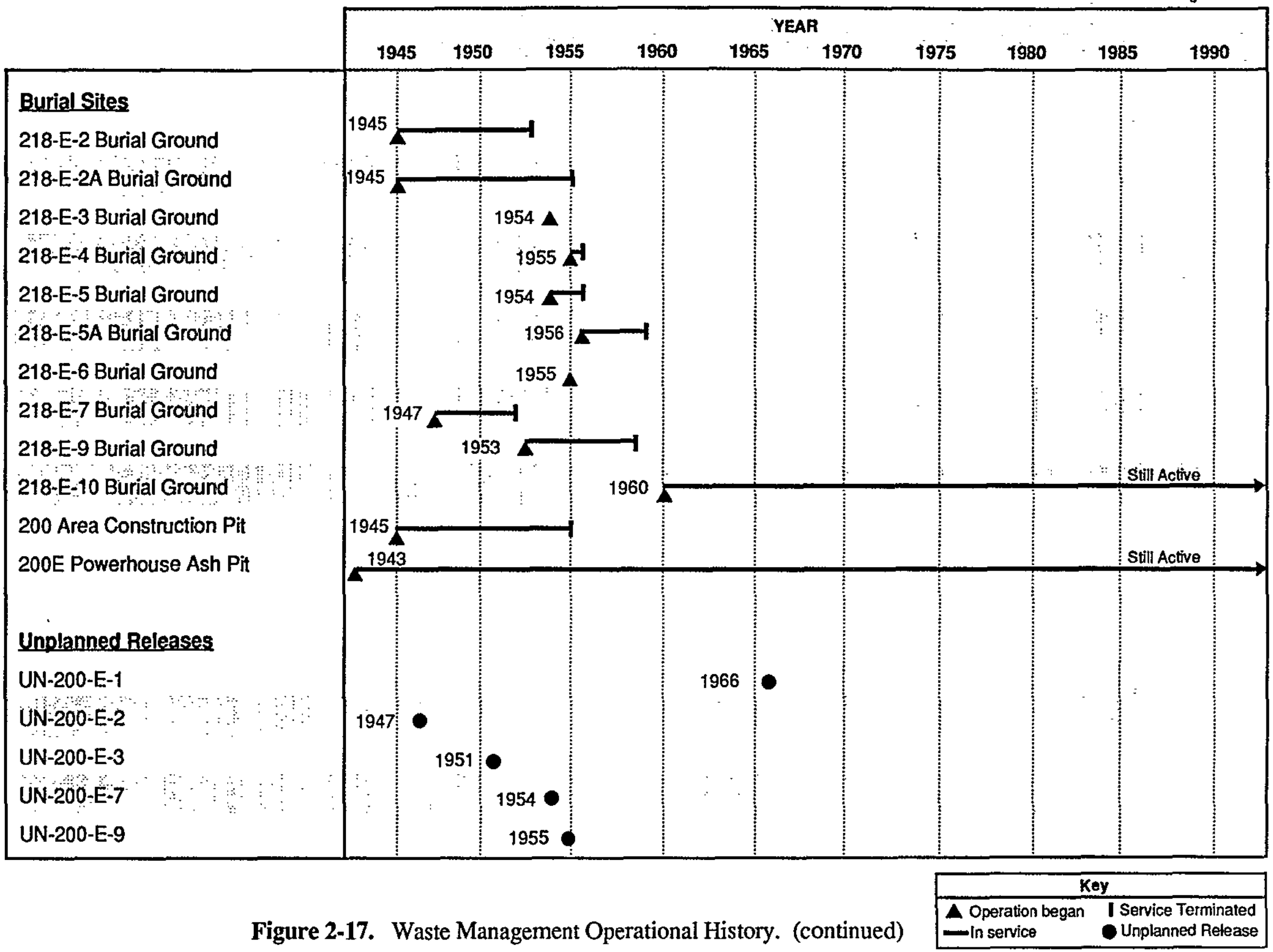


Figure 2-17. Waste Management Operational History. (continued)

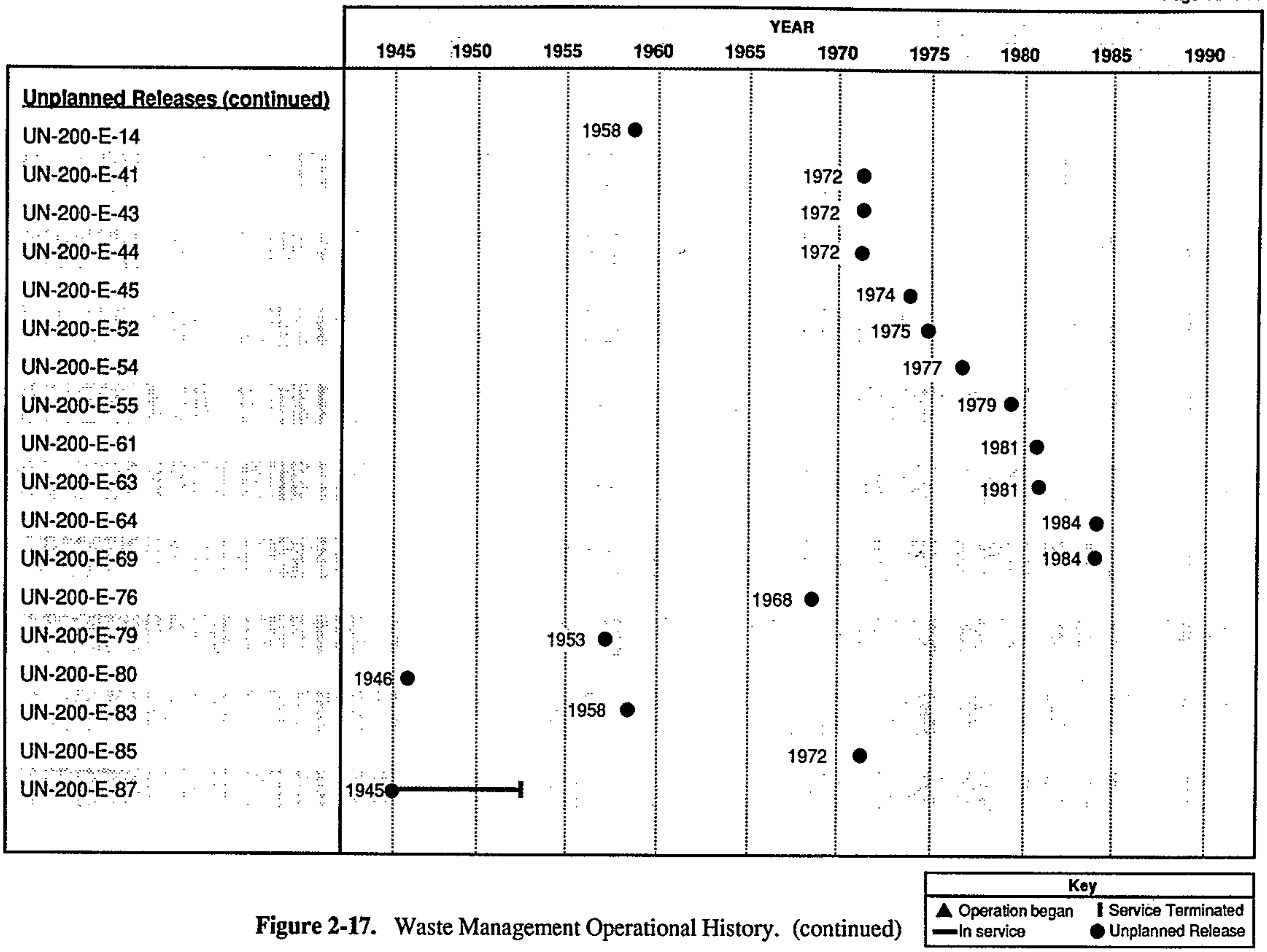


Figure 2-17. Waste Management Operational History. (continued)

Unplanned Releases (continued)	YEAR (Unplanned Release)
UN-200-E-89	1978
UN-200-E-90	1980
UN-200-E-92	1980
UN-200-E-95	1980
UN-200-E-101	1986
UN-200-E-103	1972
UN-200-E-105	1952
UN-200-E-109	1953
UN-200-E-110	1955
UN-200-E-112	1979
UN-200-E-140	1986
UPR-200-E-4	1951
UPR-200-E-5	1951
UPR-200-E-6	1954
UPR-200-E-32	1963
UPR-200-E-34	1964
UPR-200-E-38	1968
UPR-200-E-51	1977
UPR-200-E-73	1951

Key: ▲ Operation began; ▮ Service Terminated; — In service; ● Unplanned Release

Figure 2-17. Waste Management Operational History. (continued)

9 2 1 2 . . 3 1 9 3

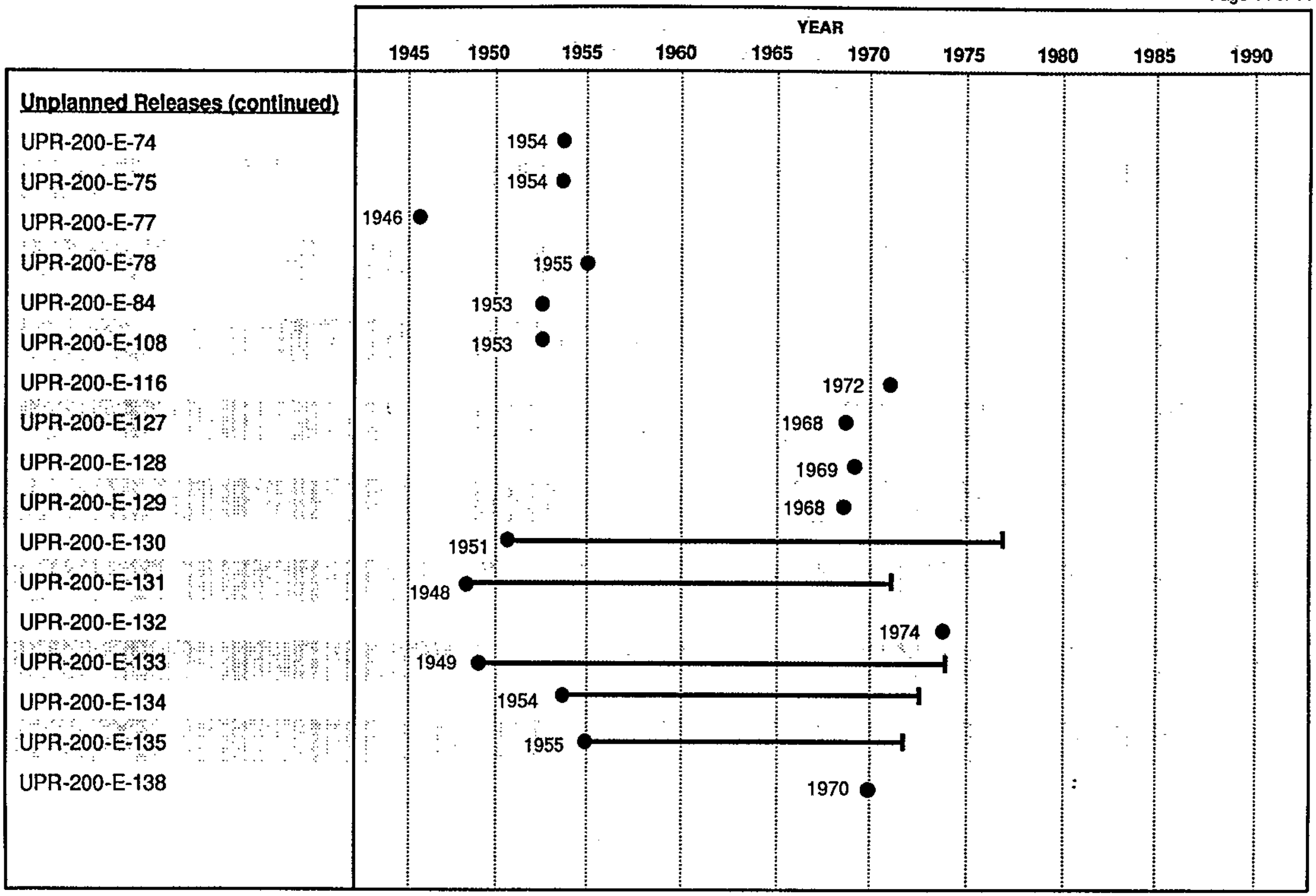
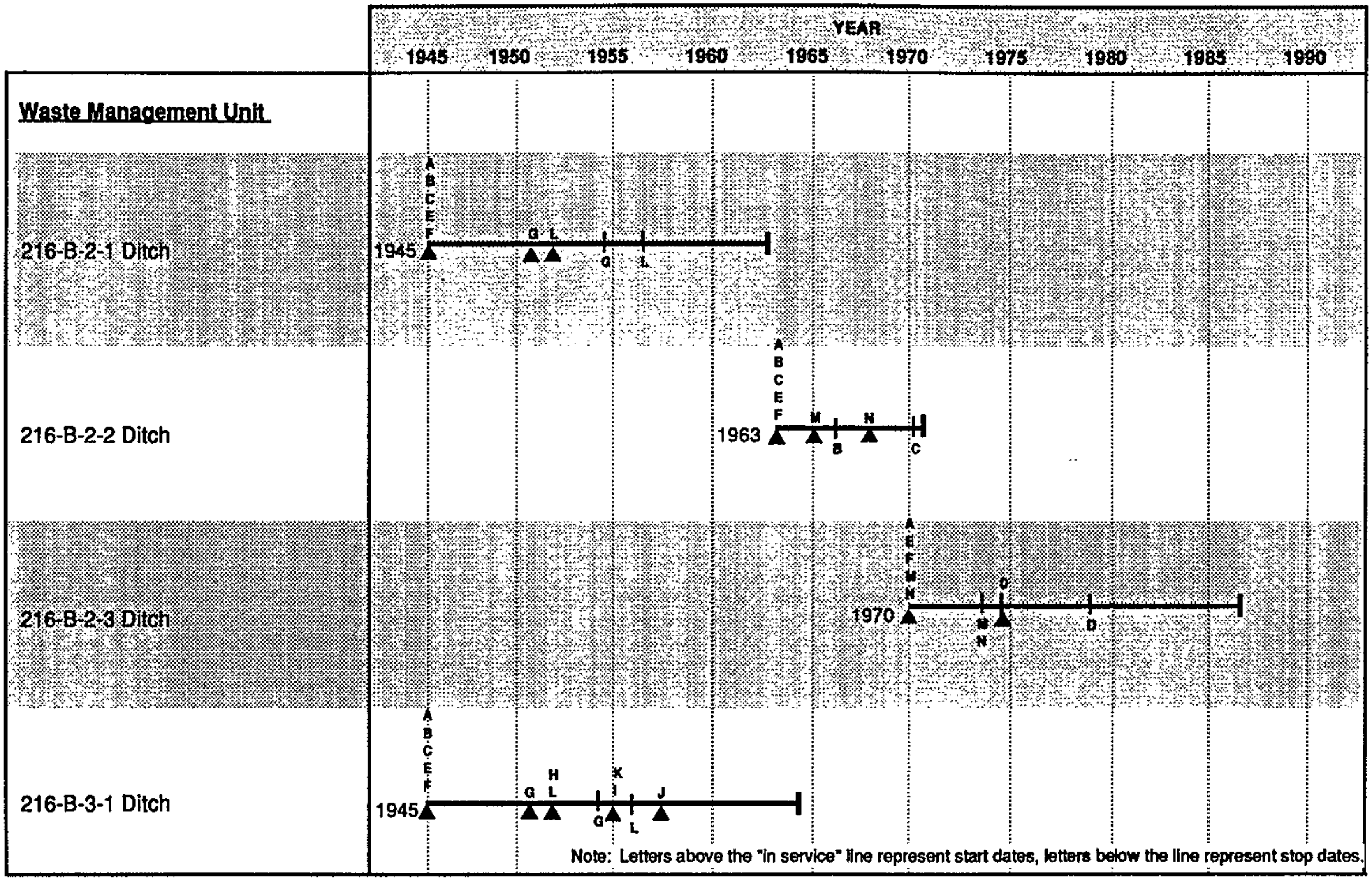


Figure 2-17. Waste Management Operational History. (continued)

Key
▲ Operation began | Service Terminated
— In service ● Unplanned Release

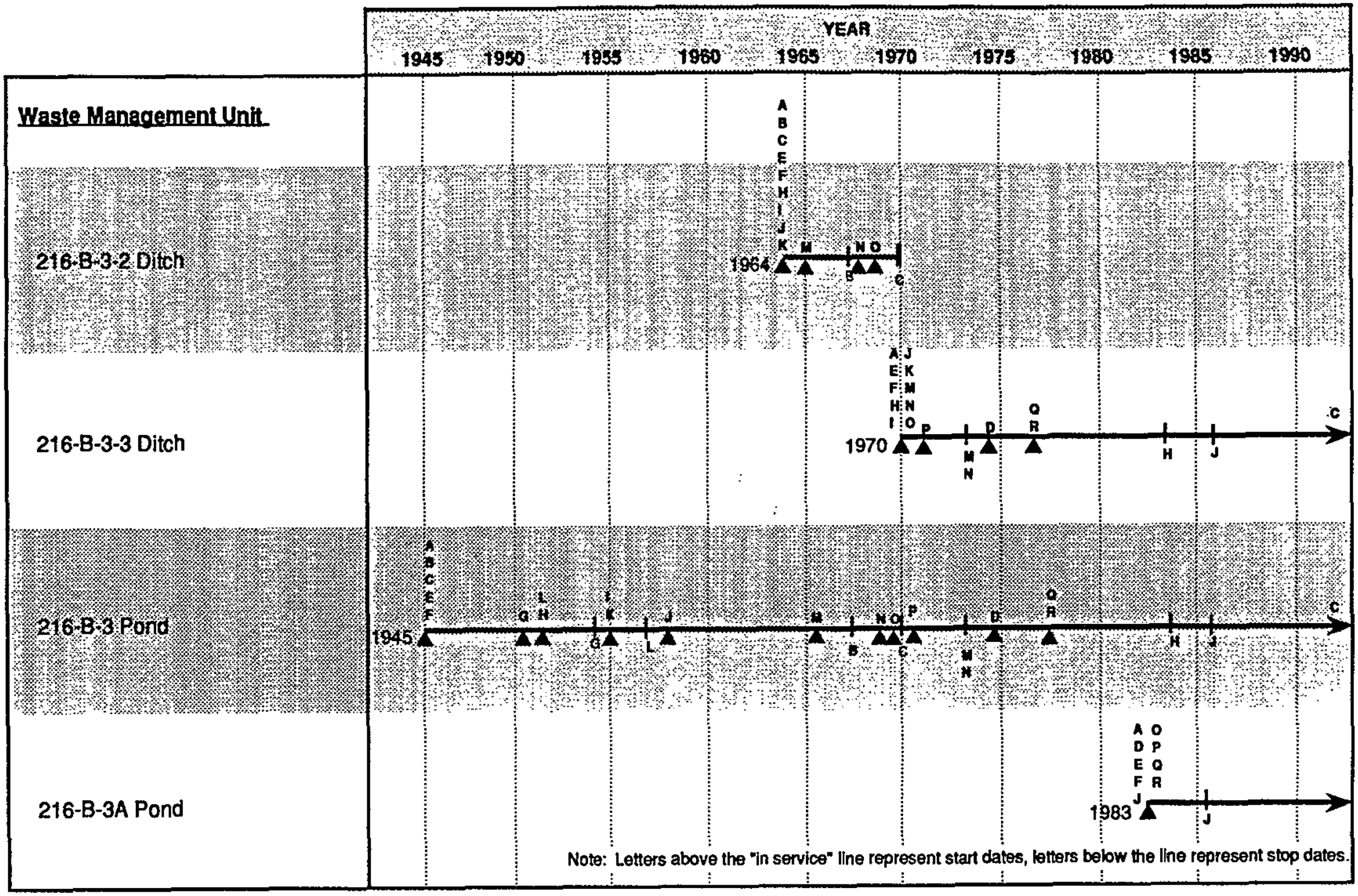


A	B Plant Cooling Water (221-B) (CBC)	E	284-E Powerhouse Effluent	I	Purex Chemical Sewer (CSL)	M	In-Tank Solidification Unit No. 1	Q	242-A Evaporator Cooling Water
B	B Plant Steam Condensate	F	283-E Water Treatment Facility	J	Acid Fractionator Condensate (Purex)	N	In-Tank Solidification Unit No. 2	R	242-A Evaporator Steam Condensate
C	B Plant Chemical Sewer (BCE)	G	242-B Evaporator Cooling Water	K	Purex Cooling Water (CWL)	O	244-AR Vault Liquid Effluent	S	241-A-431 Cooling Water
D	B Plant Cooling Water (WESF) (CBC)	H	244-CR Vault Cooling Water	L	244-BXR Vault Cooling Water	P	241-A Aging Waste Ventilation System Complex		

Key
▲ Operation began
I Service Terminated
— In service

Figure 2-18. Operational History for the 216-B-3 Pond System and Associated Waste Management Units.

Page 2 of 3



A B Plant Cooling Water (221-B) (CBC)
B B Plant Steam Condensate
C B Plant Chemical Sewer (BCE)
D B Plant Cooling Water (WESF) (CBC)
E 284-E Powerhouse Effluent
F 283-E Water Treatment Facility
G 242-B Evaporator Cooling Water
H 244-CR Vault Cooling Water
I Purex Chemical Sewer (CSL)
J Acid Fractionator Condensate (Purex)
K Purex Cooling Water (CWL)
L 244-BXR Vault Cooling Water
M In-Tank Solidification Unit No. 1
N In-Tank Solidification Unit No. 2
O 244-AR Vault Liquid Effluent
P 241-A Aging Waste Ventilation System Complex
Q 242-A Evaporator Cooling Water
R 242-A Evaporator Steam Condensate
S 241-A-431 Cooling Water

Key
▲ Operation began
❙ Service Terminated
— In service

Figure 2-18. Operational History for the 216-B-3 Pond System and Associated Waste Management Units.

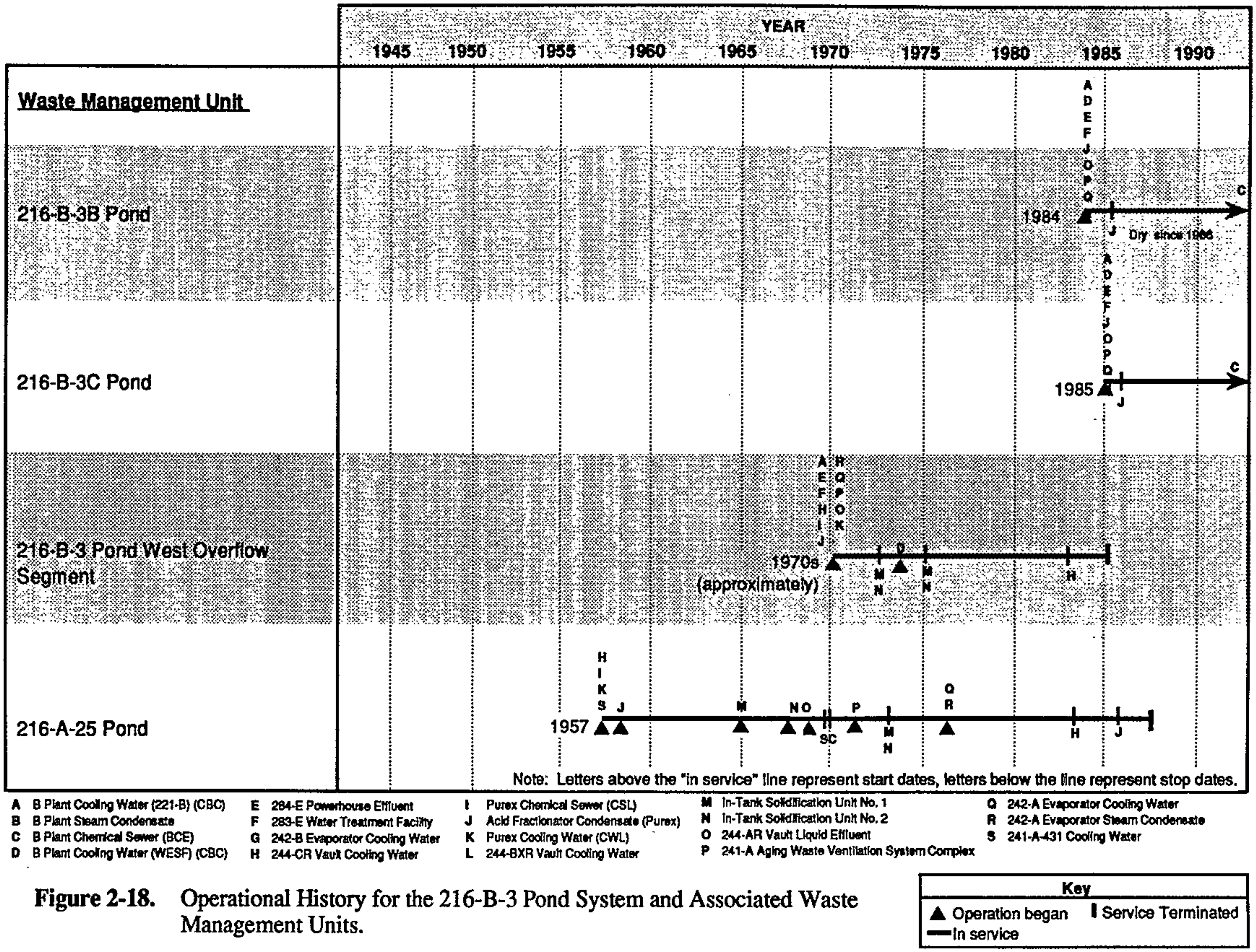


Figure 2-18. Operational History for the 216-B-3 Pond System and Associated Waste Management Units.

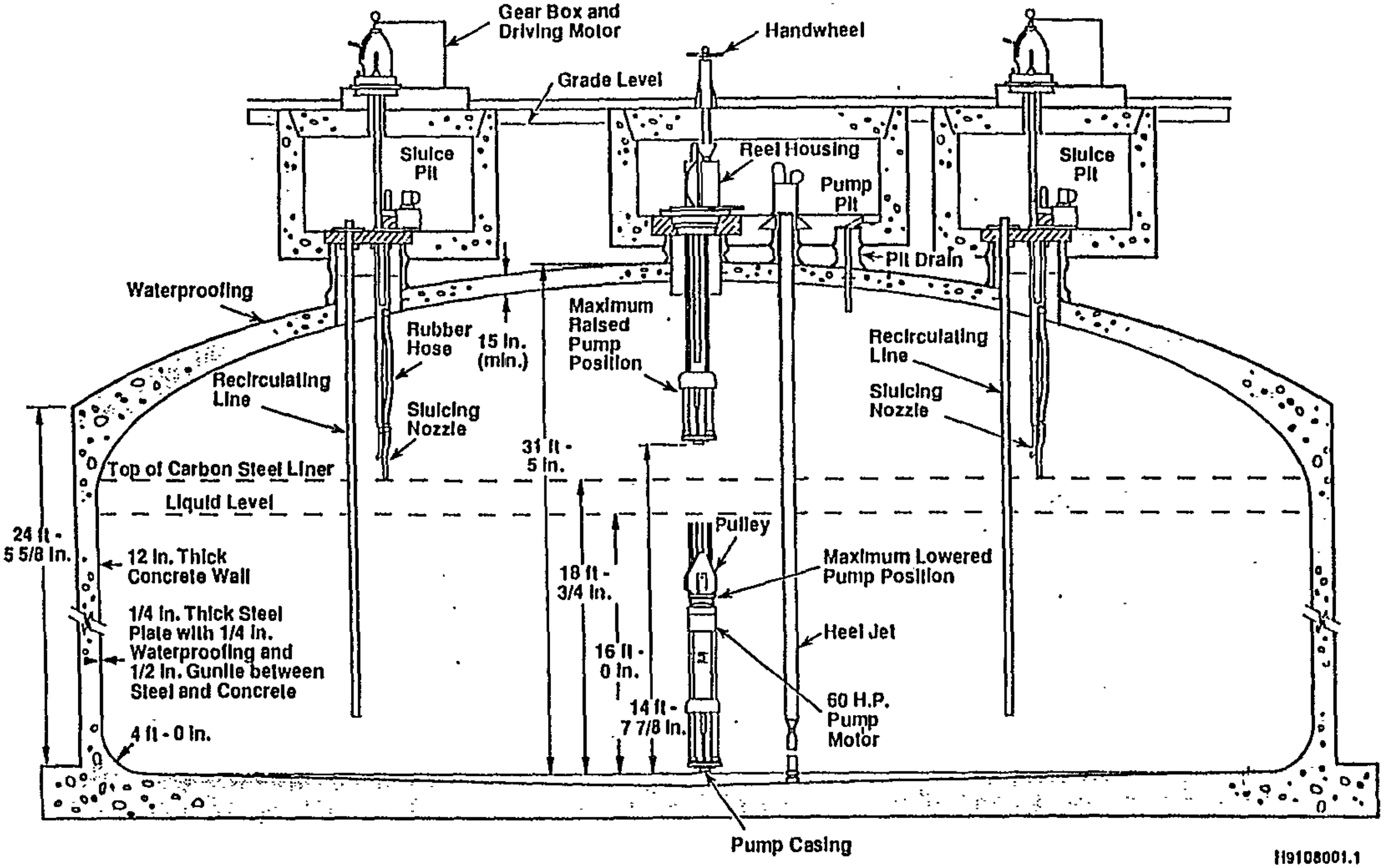


Figure 2-19. Representative Single-Shell Tank.

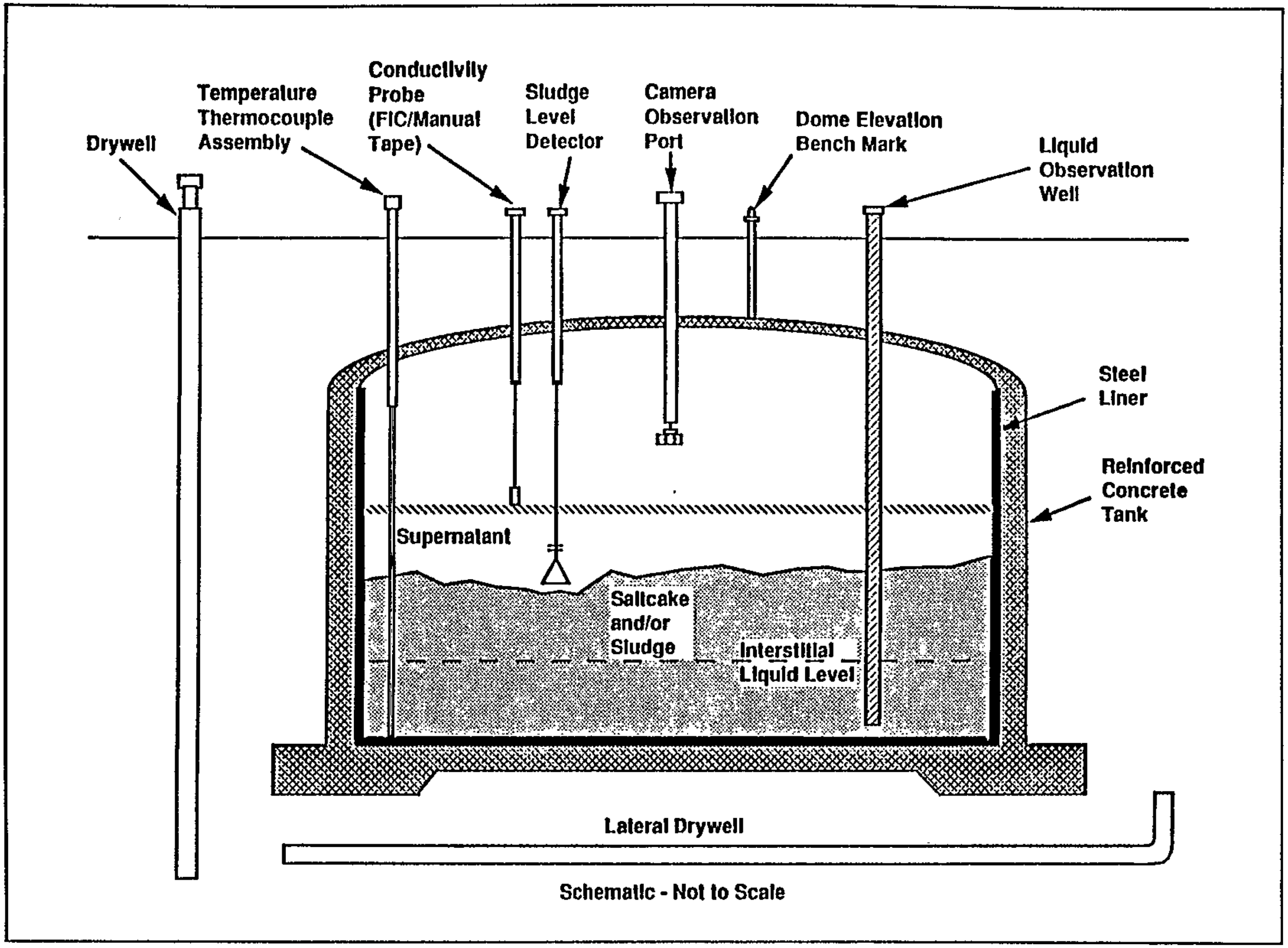


Figure 2-20. Single-Shell Tank Instrumentation Configuration.

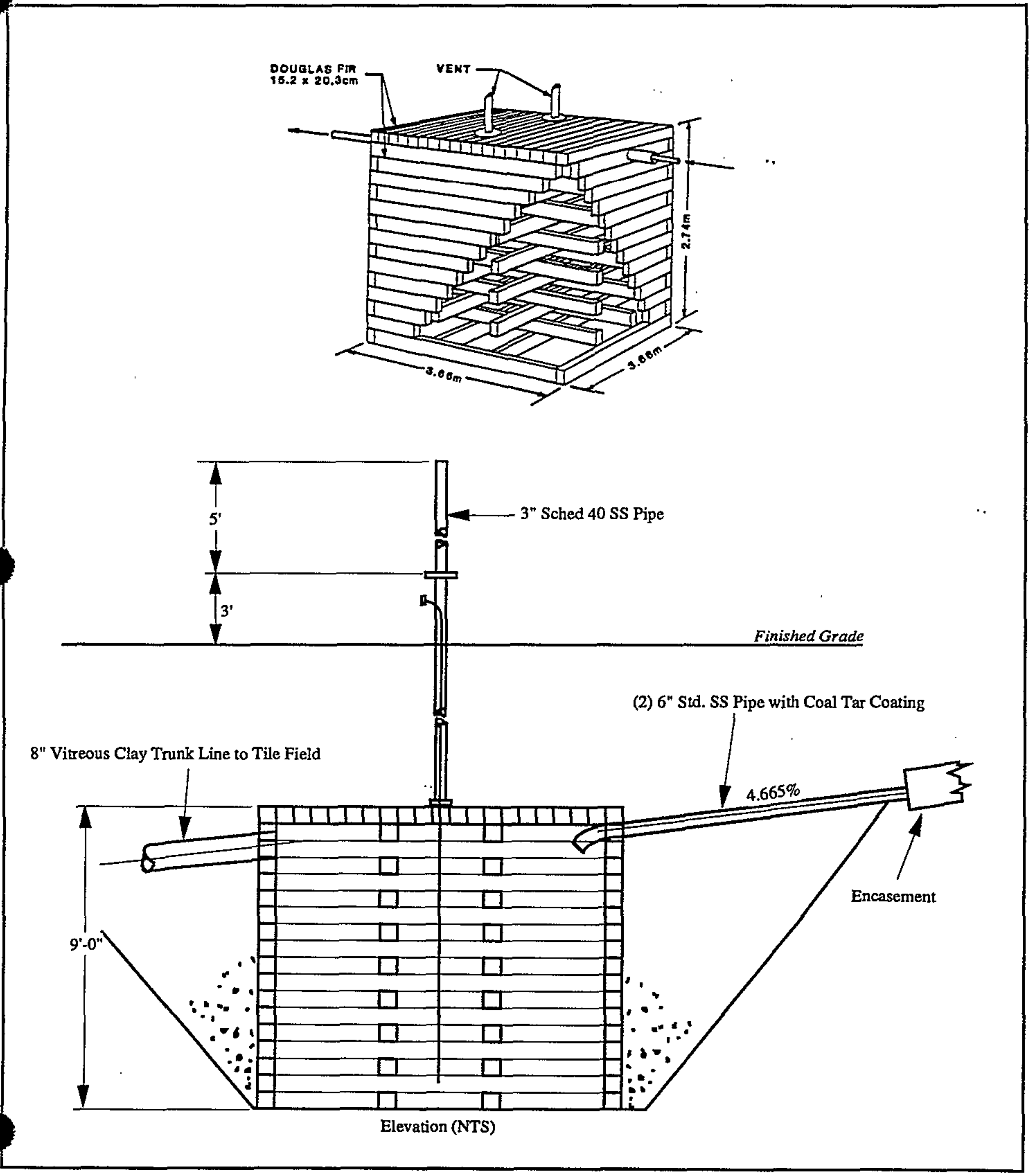


Figure 2-21. Representative Wooden Cribs.

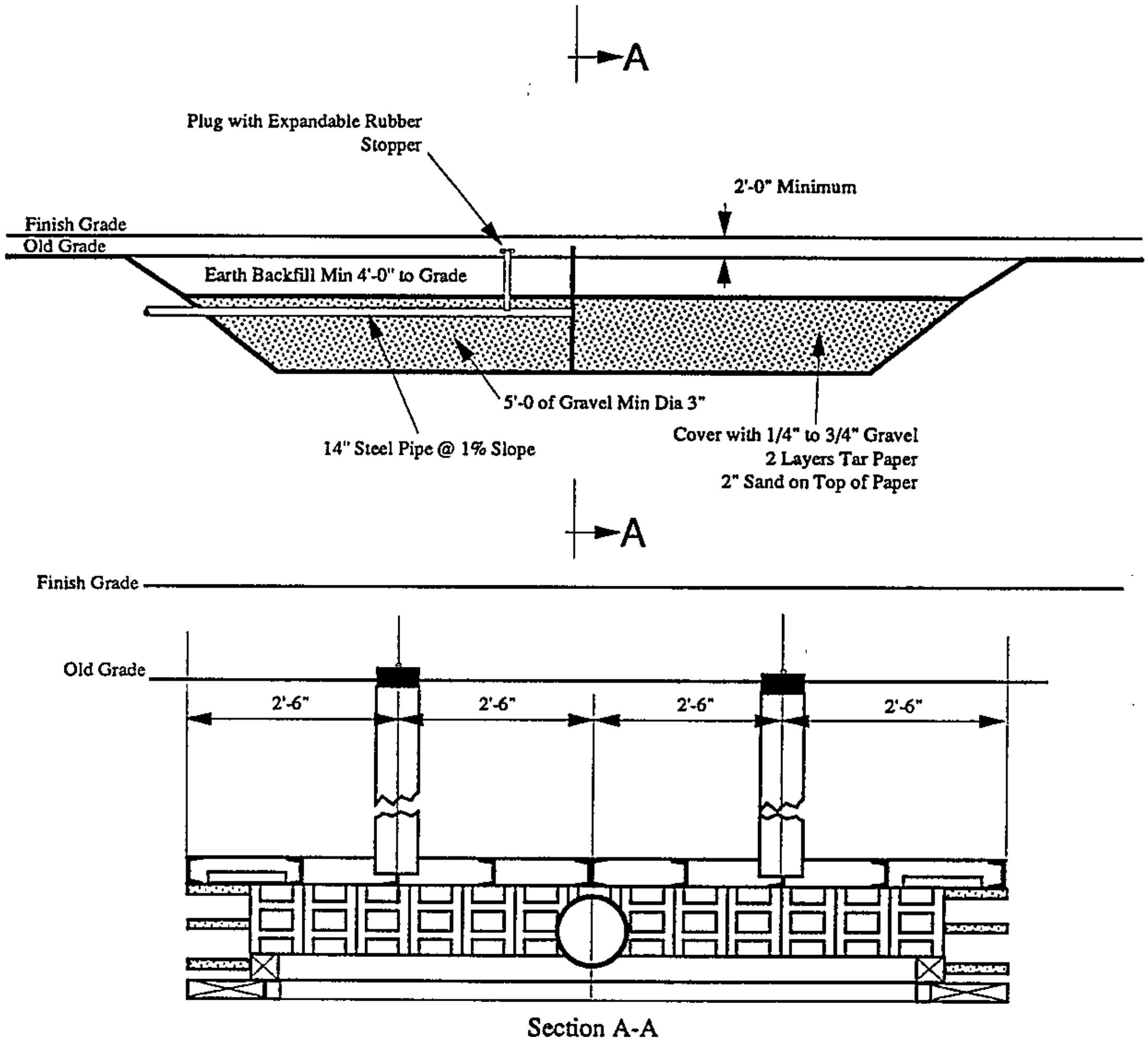


Figure 2-22. Cross Sections of the 216-B-14 through 216-B-19 Cribs.

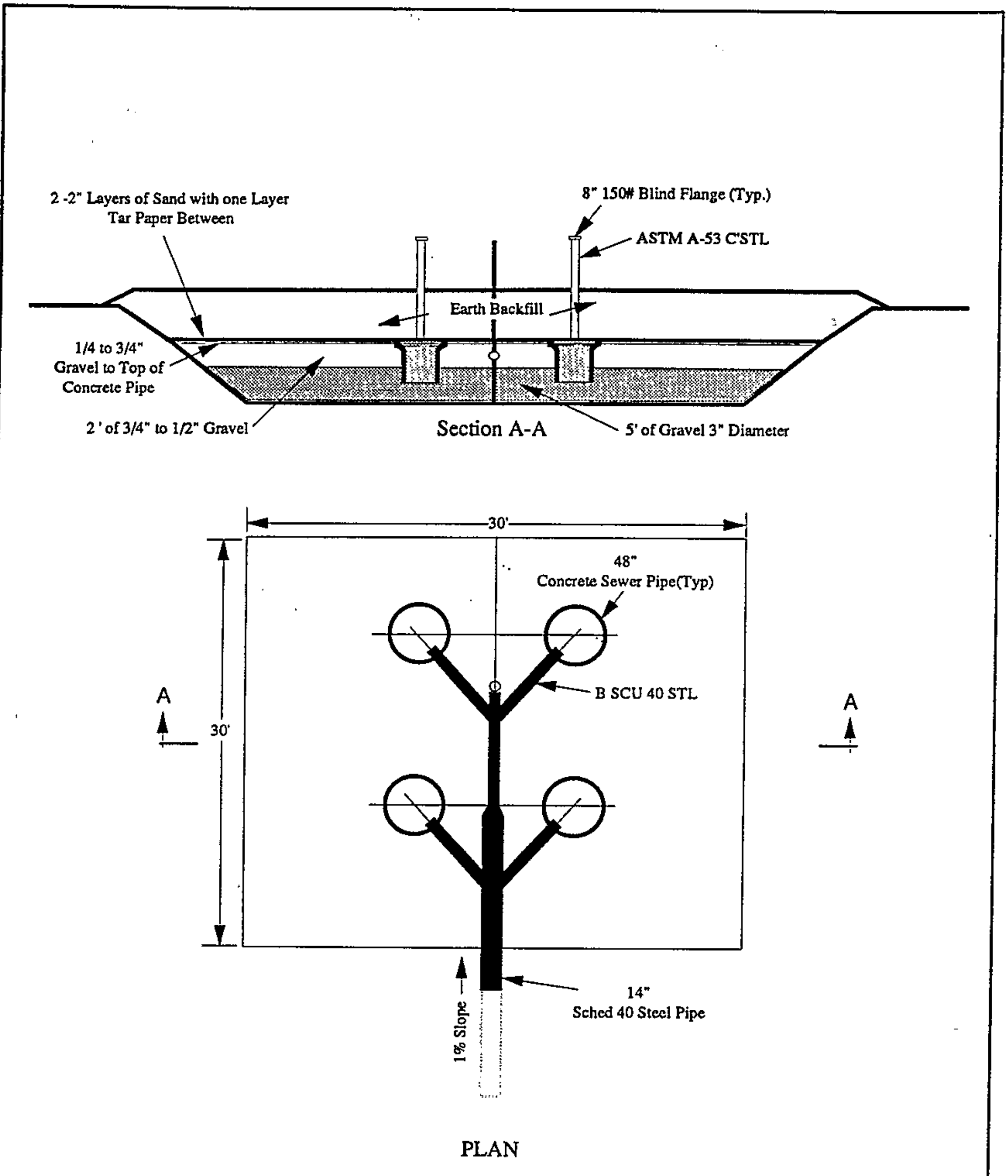


Figure 2-23. Cross Section and Plan View of the 216-B-43 through -50 Cribs.

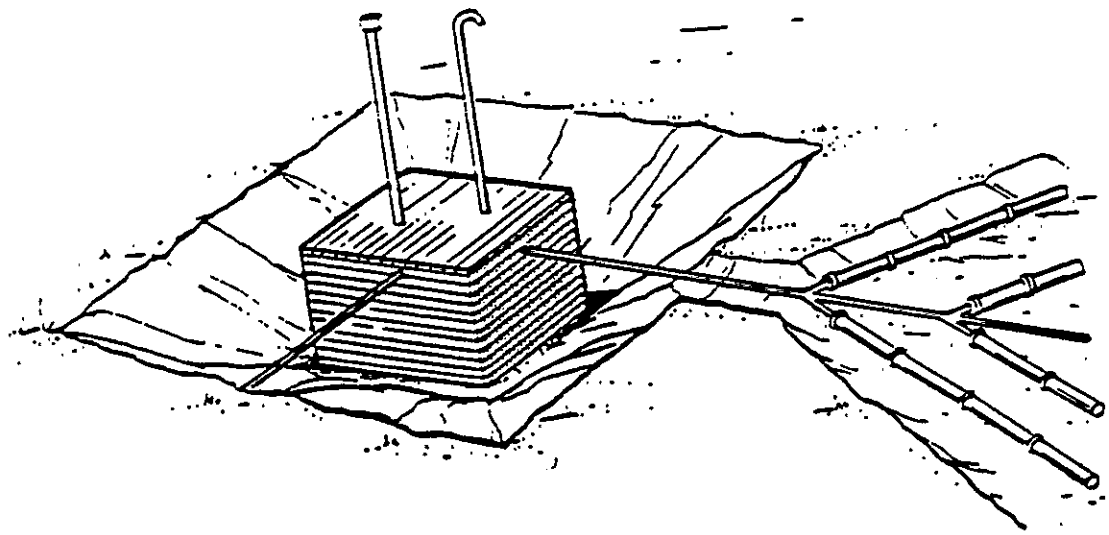


Figure 2-24. Schematic of Wooden Crib and Tile Field.

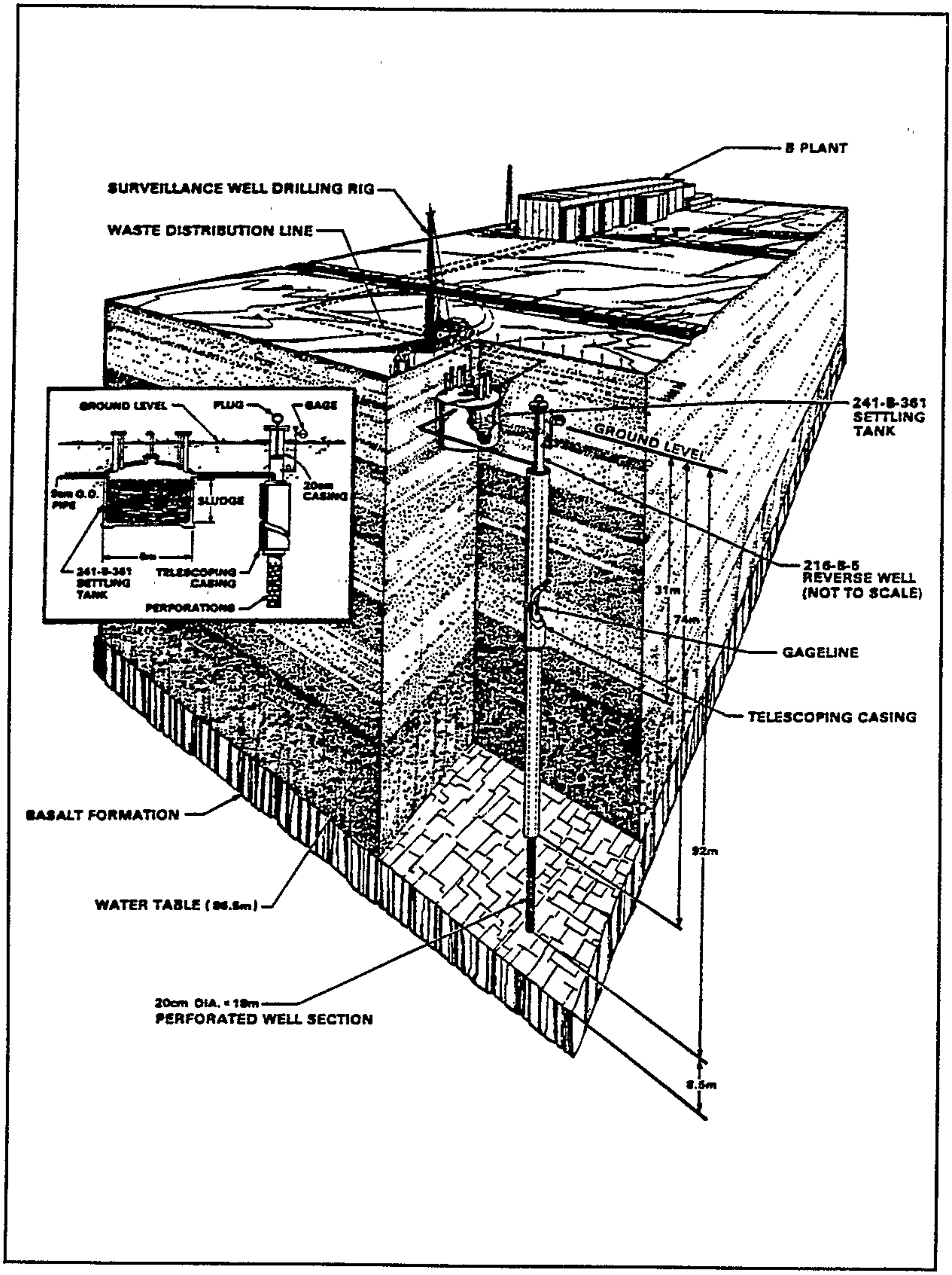


Figure 2-25. 216-B-5 Reverse Well Disposal System.

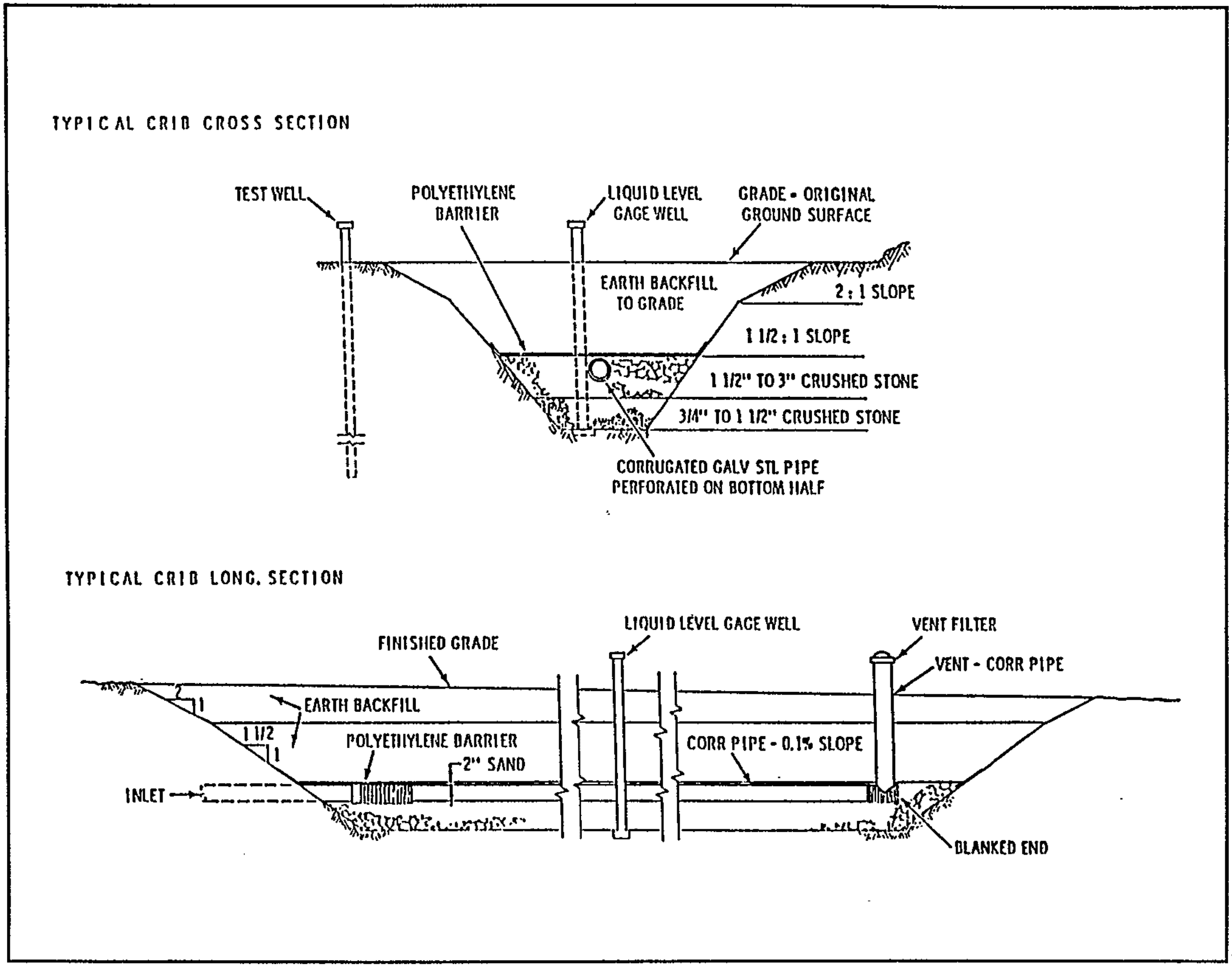


Figure 2-26. Typical Crib Construction for 216-B-55 through 216-B-62 Cribs.

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
		Plants, Buildings, and Storage Area		
226-B HWSA	unknown/*active*	Halogenated hydrocarbons, PCBs, flammable solvents, alkaline liquids, antifreeze, miscellaneous toxic chemicals.	NA	200-B-6
2703-E HWSA Staging Area	1984-present/*active*	Temporary storage of hazardous chemicals, such as alkaline liquids, sodium hydroxide, sodium dichromate containing process solutions, waste acids.	NA	200-SS-1
2704-E HWSA	Nov 1984-present/*active*	Antifreeze, grease, diesel, asphalt.	NA	200-SS-1
2715-EA HWSA	Nov 1984-present/*active*	Paint and thinning solvents.	NA	200-SS-1
		Tanks and Vaults		
241-B-101 Single-Shell Tank	May 1945-1974	$Bi(PO)_4$ metal waste; PUREX coating waste: B Plant high-level waste (Cell 23); evaporator bottoms from 241-B tanks.	--	200-BP-7
241-B-102 Single-Shell Tank	Oct 1945-1978	$Bi(PO)_4$ metal waste; PUREX coating waste; supernatant containing B Plant low-level, ion exchange, evaporator bottoms.	--	200-BP-7
241-B-103 Single-Shell Tank	Dec 1953-1977	$Bi(PO)_4$ metal waste; PUREX coating waste; B Plant low level waste, ion exchange, evaporator bottoms, N Reactor, organic wash, PNL, REDOX high-level waste, coating waste, decon, tributyl phosphate and lab waste.	--	200-BP-7
241-B-104 Single-Shell Tank	Aug 1946-1972	$Bi(PO)_4$ 2-C and 1-C; evaporator bottoms from 241-B Tanks.	--	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-B-105 Single-Shell Tank	Jan 1947-1972	$Bi(PO)_4$ 2-C and 1-C; flush water containing evaporator bottoms from 241-B Tanks.	--	200-BP-7
241-B-106 Single-Shell Tank	Sept 1947-1977	$Bi(PO)_4$ 2-C and 1-C; Hanford Lab operations, evaporator bottoms, tributyl phosphate waste, 224-U waste, PNL, B Plant low-level, ion exchange.	--	200-BP-7
241-B-107 Single-Shell Tank	May 1945-1969	PUREX coating waste, $Bi(PO)_4$ 1-C and 2-C, evaporator bottoms.	--	200-BP-7
241-B-108 Single-Shell Tank	1945-1977	$Bi(PO)_4$ 1-C and 2-C, PUREX coating waste, evaporator bottoms, ion exchange from 241-B and -BY Tank Farms.	--	200-BP-7
241-B-109 Single-Shell Tank	Jan 1946-1977	$Bi(PO)_4$ 1-C, PUREX coating waste, evaporator bottoms, ion exchange 224-U waste, coating waste from 241-B, -BY, -S Tank Farms.	--	200-BP-7
241-B-110 Single-Shell Tank	May 1945-1971	$Bi(PO)_4$ 2-C and 1-C, fission product waste, B Plant high-level waste fractionization, B Plant Cells 5 and 6; B Plant flushes, ion exchange.	--	200-BP-7
241-B-111 Single-Shell Tank	Nov 1945-1976	$Bi(PO)_4$ 2-C, fission product waste, ion exchange (waste fractionization), B Plant Cells 5 and 6.	--	200-BP-7
241-B-112 Single-Shell Tank	April 1946-1977	$Bi(PO)_4$ 2-C, fission product waste, evaporator bottoms from 241-B and -BX B Plant Cells 5 and 6, ion exchange.	--	200-BP-7
241-B-201 Single-Shell Tank	1952-1971	224-U wastes (lanthanum fluoride).	--	200-BP-7
241-B-202 Single-Shell Tank	1951-1977	224-U wastes (lanthanum fluoride), B Plant high-level waste.	--	200-BP-7
241-B-203 Single-Shell Tank	1951-1977	224-U wastes (lanthanum fluoride).	--	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-B-204 Single-Shell Tank	1951-1977	224-U wastes (lanthanum fluoride), B Plant flushes.	--	200-BP-7
241-B-301B Catch Tank	1945-June 1984	Processing and decon wastes.	--	200-BP-7
241-B-302B Catch Tank	1945-July 1985	Processing and decon wastes.	0	200-BP-5
241-B-361 Settling Tank	April 1945-Sep 1947	Low salt, alkaline radioactive from cell washings collected in 5-6W Cell in 221-B and from 224-B. Solids primarily $Bi(PO)_4$.	121	200-BP-5
241-BX-101 Single-Shell Tank	Jan 1948-1972	$Bi(PO)_4$ metal waste; B Plant low-level waste, ion exchange (waste fractionization), evaporator bottoms, N Reactor, organic wash, REDOX ion exchange waste, tributyl phosphate and coating waste.	--	200-BP-7
241-BX-102 Single-Shell Tank	June 1948-1971	$Bi(PO)_4$ metal waste, diatomaceous earth, tributyl phosphate, metal, and coating waste, B Plant low level, evaporator bottoms.	--	200-BP-7
241-BX-103 Single-Shell Tank	Sept 1948-1977	$Bi(PO)_4$ metal waste; PUREX high- and low-level waste and sludge supernatant; exchange, evaporator bottoms, N Reactor, organic wash, PNL, REDOX ion exchange waste, coating waste, decon, tributyl phosphate and lab waste, B Plant low-level.	--	200-BP-7
241-BX-104 Single-Shell Tank	1949-1980	$Bi(PO)_4$ metal waste; PUREX coating waste, ion exchange (waste fractionization) evaporator bottoms, REDOX high-level, complexed and noncomplexed waste, double-shell slurry feed, tributyl phosphate and lab waste, B Plant low-level, ion exchange.	--	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-BX-105 Single-Shell Tank	1949-1980	$Bi(PO)_4$ metal waste, tributyl phosphate waste, coating, ion exchange waste; evaporator bottoms, complexed and noncomplexed waste, double-shell slurry feed.	--	200-BP-7
241-BX-106 Single-Shell Tank	1949-1977	$Bi(PO)_4$ metal waste, tributyl phosphate waste, coating, ion exchange waste; evaporator bottoms, B Plant low-level, organic wash, REDOX ion exchange waste from 241-B, -BX, and -BY tanks.	--	200-BP-7
241-BX-107 Single-Shell Tank	Sept 1948-1977	$Bi(PO)_4$ 1-C, tributyl phosphate waste, ion exchange waste from the 241-BX Tank Farm.	--	200-BP-7
241-BX-108 Single-Shell Tank	1949-1974	$Bi(PO)_4$ 1-C, tributyl phosphate waste, coating, ion exchange waste from the 241-BX and -C Tanks.	--	200-BP-7
241-BX-109 Single-Shell Tank	1950-1974	$Bi(PO)_4$ 1-C; ion exchange (waste fractionization), tributyl phosphate waste, tributyl phosphate waste from the 241-BY and -C Tanks.	--	200-BP-7
241-BX-110 Single-Shell Tank	1949-1977	$Bi(PO)_4$ 1-C, ion exchange (waste fractionization), tributyl phosphate waste, evaporator bottoms, coating waste, B Plant 1-C from the 241-B and -C Tank Farms. It is an ITS-2 Unit.	--	200-BP-7
241-BX-111 Single-Shell Tank	1950-1977	$Bi(PO)_4$ 1-C, ITS-2 bottoms and recycle systems, evaporator bottoms, coating waste, ion exchange waste, 1-C from the 241-BY Tanks.	--	200-BP-7
241-BX-112 Single-Shell Tank	1950-1977	Ion exchange (waste fractionization), evaporator bottoms, coating waste, 1-C from the 241-C Tanks.	--	200-BP-7
241-BX-302A Catch Tank	1948-July 1985	Processing and decon wastes.	--	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-BX-302B Catch Tank	1948-July 1985	Processing and decon wastes.	--	200-BP-6
241-BX-302C Catch Tank	1948-July 1985	Processing and decon wastes.	--	200-BP-6
241-BY-101 Single-Shell Tank	Jan 1950-1971	$Bi(PO)_4$ metal waste, tributyl phosphate waste, evaporator bottoms from the 241-BY and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-102 Single-Shell Tank	1950-1977	$Bi(PO)_4$ metal waste, tributyl phosphate and coating waste, evaporator bottoms from the 241-BX, -BY and -C farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-103 Single-Shell Tank	Nov 1950-May 1973	$Bi(PO)_4$ metal waste, PUREX coating waste, evaporator bottoms, coating and tributyl phosphate waste, PUREX high-level and organic wash wastes from 241-BX, -BY, -C, and -B Tanks. This is an ITS-2 Unit.	--	200-BP-7
241-BY-104 Single-Shell Tank	1950-1977	$Bi(PO)_4$ metal waste, tributyl phosphate and coating waste, evaporator bottoms from the 241-BX, -BY and -C Tank Farms, and ion exchange waste. This is an ITS-2 Unit.	--	200-BP-7
241-BY-105 Single-Shell Tank	June 1951-1974	tributyl phosphate waste, $Bi(PO)_4$ metal waste and coating waste, evaporator bottoms from the 241-BY and -C Tank Farms, concrete. This is an ITS-2 Unit.	--	200-BP-7
241-BY-106 Single-Shell Tank	1953-1977	I-C and $Bi(PO)_4$ 1-C waste, tributyl phosphate waste, coating waste, evaporator bottoms from 241-BY and -C Tank Farms. It is an ITS-2 Unit.	--	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-BY-107 Single-Shell Tank	December 1950-1974	tributyl phosphate waste, $Bi(PO)_4$ 1-C waste and coating waste, evaporator bottoms from the 241-BY and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-108 Single-Shell Tank	April 1951-1972	$Bi(PO)_4$ 1-C waste, evaporator bottoms from the 241-BY and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-109 Single-Shell Tank	1953-1979	Supernatant containing tributyl phosphate waste, PUREX coating waste, $Bi(PO)_4$ metal waste, evaporator bottoms, PUREX organic wash waste from the 241-B, -BX, -BY, and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-110 Single-Shell Tank	1952-1979	$Bi(PO)_4$ 1-C waste, tributyl phosphate waste, evaporator bottoms, coating waste from the 241-BY and -C Tank Farms, and the WR-241 Tank.	--	200-BP-7
241-BY-111 Single-Shell Tank	1952-1977	$Bi(PO)_4$ metal waste, tributyl phosphate waste, PUREX coating waste, organic wash waste, evaporator bottoms, coating waste, and organic was waste from the 241-BY and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
241-BY-112 Single-Shell Tank	1951-1976	$Bi(PO)_4$ metal waste, tributyl phosphate waste, coating waste, evaporator bottoms from the 241-B, -BX, -BY, and -C Tank Farms. This is an ITS-2 Unit.	--	200-BP-7
244-BXR Receiving Vault	1948-July 1985	Process and decon wastes.	--	200-BP-7
241-ER-311 Catch Tank	1945-present/*active*	Process and decon wastes.	--	200-BP-9

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
270-E Cond. Neutralization Tank	1952-1976	Sludge	14.7	200-BP-6
		Cribs and Drains		
216-B-7A & B Crib	Oct 1946-May 1967	224-B via overflow from 201-B Tank, cell drainage from Tank 5-6 in 221-B, equipment cleanout waste from 224-B, decon and construction waste from 221-B.	43,600	200 BP-4
216-B-8TF Crib	April 1948-July 1953	2-C supernatant from 221-B, cell drainage and other waste from Tank 5-6, decon and cleanup waste generated i shutdown of 224-B.	27,200	200-BP-4
216-B-9TF Crib	Aug 1948-July 1951	Cell drainage and other liquid waste via Tank 5-6 in 221-B.	36,000	200-BP-5
216-B-10A Crib	Dec 1949-Jan 1952	Decon sink and sample slurper waste from 222-B and floor drainage from 292-B.	9,990	200-BP-6
216-B-10B Crib	June 1969-Oct 1973	Decon sink and shower waste from 221-B, overflow from 216-10A.	28	200-BP-6
216-B-12 Crib	Nov 1952-Nov 1973	Process condensate from 221-U and 224-U waste evaporators, construction waste from 221-B and process condensate from 221-B.	520,000	200-BP-9
216-B-14 Crib	Jan 1956-Feb 1956	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	8,710	200-BP-2
216-B-15 Crib	April 1956-Dec 1956	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	6,320	200-BP-2
216-B-16 Crib	April 1956-Aug 1956	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	5,600	200-BP-2

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-B-17 Crib	Jan 1956-Jan 1956	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	3,410	200-BP-2
216-B-18 Crib	March 1956-April 1956	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	8,520	200-BP-2
216-B-19 Crib	Feb 1957-Oct 1957	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	6,400	200-BP-2
216-B-43 Crib	Nov 1954	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	2,120	200-BP-1
216-B-44 Crib	Nov 1954-March 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	5,600	200-BP-1
216-B-45 Crib	April 1955-June 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	4,920	200-BP-1
216-B-46 Crib	Sept 1955-Dec 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	6,700	200-BP-1
216-B-47 Crib	Sept 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	3,710	200-BP-1
216-B-48 Crib	Nov 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	4,090	200-BP-1
216-B-49 Crib	Nov 1955-Dec 1955	Scavenged tributyl phosphate supernatant from 221-U during uranium recovery operations.	6,700	200-BP-1
216-B-50 Crib	Jan 1965-Jan 1974	Waste storage tank condensate from the ITS-1 unit in the 241-BY Tank Farms	54,800	200-BP-1
216-B-55 Crib	Sept 1967-present/*active*	Steam condensate from 221-B.	1,230,000	200-BP-9

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units. Page 9 of 18

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-B-56 Crib	Not Used	Waste storage tank condensate from the ITS-2 unit in the 241-BY Tank Farm.	0	200-BP-5
216-B-57 Crib	Feb 1968-June 1973	Waste storage tank condensate from the ITS-2 unit in the 241-BY Tank Farm.	84,400	200-BP-1
216-B-60 Crib	Nov 1967	Cell cleanout solid and liquid waste from the 24 in. sewer in 221-B.	18.9	200-BP-6
216-B-61 Crib	Not Used	Not used.	0	200-BP-1
216-B-62 Crib	Nov 1973-present/*active*	Process condensate from the 221-B Separations Facilities.	282,000	200-BP-9
Chem TF North of 2703-E	Unknown	Mixed Waste.	Unknown	200-SS-1
216-B-13 French Drain	Aug 1947-June 1976	291-B stack drainage.	21	200-BP-6
216-B-51 French Drain	Jan 1956-Jan 1958	Flush drainage from the BC Crib pipeline.	1	200-BP-4
		Reverse Wells		
216-B-4 Reverse Well	April 1945-Dec 1949	291-B stack drainage and floor drainage from 292-B.	10	200-BP-6
216-B-5 Reverse Well	April 1945-Oct 1947	Supernatant overflow from the 216-B-361 settling tank waste via Tank 5-6 in 221-B and liquid waste from 224-B. Cell drainage and other liquid waste via Tank 5-6 in 221-B.	30,600	200-BP-5
216-B-6 Reverse Well	April 1945-Dec 1949	Decontamination sink and sample slurper waste from 222-B.	6,000	200-BP-6
216-B-11A & -11B Rev. Well	Dec 1951-Dec 1954	Process condensate from the 242-B Evaporator.	29,600	200-BP-4

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
		Ponds, Ditches, and Trenches		
216-B-3 Pond	April 1945-present/*active*	221-B steam condensate and process cooling water, 284-E Powerhouse water, 244-CR, -AR, and 242-A cooling water, 202-A process, condenser, and air sampler vacuum pump cooling water, 202-A chem sewer, fractionator condensate, WESF cooling water	240,000,000	200-BP-11
216-B-3A Pond	Oct 1983-present/*active*	221-B steam condensate and process cooling water, 284-E Powerhouse water, 244-CR, -AR, and 242-A cooling water, 202-A process, condenser, and air sampler vacuum pump cooling water, 202-A chem sewer, fractionator condensate, WESF cooling water.	Not reported	200-BP-11
216-B-3B Pond	June 1984-present/*active*	221-B steam condensate and process cooling water, 284-E Powerhouse water, 244-CR, -AR, and 242-A cooling water, 202-A process, condenser, and air sampler vacuum pump cooling water, 202-A chem sewer, fractionator condensate, WESF cooling water.	Not reported	200-BP-11
216-B-3C Pond	1985-present/*active*	221-B steam condensate and process cooling water, 284-E Powerhouse water, 244-CR, -AR, and 242-A cooling water, 202-A process, condenser, and air sampler vacuum pump cooling water, 202-A chem sewer, fractionator condensate, WESF cooling water.	Not reported	200-BP-11
216-E-28 Contingency Pond	Constructed in 1986; never used	Emergency diversion pond for the 216-B-3 Pond system	0	200-BP-11

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-A-25 Pond	Dec 1957-1987	Process cooling water from 202-A, contact condenser cooling water from 241-A-431, surface condenser cooling water from 241-A-401, 284-E Powerhouse wastewater, cooling water and steam condensate from 244-AR Vault, 242-A steam condensate cooling water and B Plant cooling water.	307,000,000	200-IU-6
216-N-8 Pond	1958-1987	Sewage sludge from Hanford construction camp.	Unknown	200-IU-6
2101-M Pond	1983-present/*active*	Swamp-cooler condensate and overflow drain wastewater from the 2101-M air conditioning system. Barium chloride lab waste solution, nitric and hydrochloric acid.	Not reported	200-SS-1
216-B-2-1 Ditch	April 1945-Nov 1963	Steam condensate, process cooling water, chem sewer from 221-B waste, 284-E Powerhouse water, 241-CR vault cooling water.	149,000,000	200-BP-8
216-B-2-2 Ditch	Nov 1963-May 1970	Steam condensate, process cooling water, chem sewer from 221-B waste, 284-E Powerhouse water, 241-CR vault cooling water, ITS-1 and -2 cooling water, cleanup waste from 207-B Retention Basin.	49,700	200-BP-8
216-B-2-3 Ditch	1970-1987	221-B cooling water, 241-CR vault cooling water, condenser cooling water from ITS-1 and -2 cooling water.	Not reported	200-BP-8

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-B-3-1 Ditch	April 1945-July 1964	Steam condensate, process cooling water, chem sewer from 221-B waste, 284-E Powerhouse waste, 241-CR vault cooling water, 242-A process cooling water and chem sewer, 202-A acid fractionator condensate, 202-A air sampler vacuum pumps seal cooling water.	149,000,000	200-BP-11
216-B-3-2 Ditch	July 1964-Sept 1970	Steam condensate, process cooling water, chem sewer from 221-B waste, 284-E Powerhouse waste, 241-CR vault cooling water, 242-A process cooling water and chem sewer, 202-A acid fractionator condensate, 202-A air sampler vacuum pumps seal cooling water, ITS-1 condenser cooling water.	149,000,000	200-BP-11
216-B-3-3 Ditch	Sept 30, 1970 - present/*active*	221-B cooling water, 202-A chem sewer, ITS-1 and -2 cooling water, 244-CR cooling water.	not reported	200-BP-11
216-B-20 Trench	Aug 1956-Sept 1956	Scavenged tributyl phosphate waste from 221-U.	4,680	200-BP-2
216-B-21 Trench	Sept 1956-Oct 1956	Scavenged tributyl phosphate waste from 221-U.	4,670	200-BP-2
216-B-22 Trench	Oct 1956	Scavenged tributyl phosphate waste from 221-U.	4,740	200-BP-2
216-B-23 Trench	Oct 1956	Scavenged tributyl phosphate waste from 221-U.	4,520	200-BP-2
216-B-24 Trench	Oct 1956-Nov 1956	Scavenged tributyl phosphate waste from 221-U.	4,700	200-BP-2
216-B-25 Trench	Nov 1956-Dec 1956	Scavenged tributyl phosphate waste from 221-U.	3,760	200-BP-2
216-B-26 Trench	Dec 1956-Feb 1957	Scavenged tributyl phosphate waste from 221-U.	5,880	200-BP-2
216-B-27 Trench	Feb 1957-April 1957	Scavenged tributyl phosphate waste from 221-U.	4,420	200-BP-2
216-B-28 Trench	April 1957-June 1957	Scavenged tributyl phosphate waste from 221-U.	5,050	200-BP-2

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-B-29 Trench	June 1957-July 1957	Scavenged tributyl phosphate waste from 221-U.	4,840	200-BP-2
216-B-30 Trench	July 1957	Scavenged tributyl phosphate waste from 221-U.	4,780	200-BP-2
216-B-31 Trench	July 1957-Aug 1957	Scavenged tributyl phosphate waste from 221-U.	4,740	200-BP-2
216-B-32 Trench	Aug 1957-Sept 1957	Scavenged tributyl phosphate waste from 221-U.	4,770	200-BP-2
216-B-33 Trench	Sept 1957-Oct 1957	Scavenged tributyl phosphate waste from 221-U.	4,740	200-BP-2
216-B-34 Trench	Oct 1957	Scavenged tributyl phosphate waste from 221-U.	4,870	200-BP-2
216-B-35 Trench	Feb 1954-March 1954	1-C supernatant from 221-B.	1,060	200-BP-3
216-B-36 Trench	March 1954-April 1954	1-C supernatant from 221-B.	1,940	200-BP-3
216-B-37 Trench	Aug 1954	1-C bottom supernatant waste from the 242-B waste evaporator.	4,320	200-BP-3
216-B-38 Trench	July 1954	1-C supernatant from 221-B.	1,430	200-BP-3
216-B-39 Trench	Dec 1953-Nov 1954	1-C supernatant from 221-B.	1,540	200-BP-3
216-B-40 Trench	April 1954-July 1954	1-C supernatant from 221-B.	1,640	200-BP-3
216-B-41 Trench	Nov 1954	1-C supernatant from 221-B.	1,440	200-BP-3
216-B-42 Trench	Jan 1955-Feb 1955	Scavenged tributyl phosphate waste from 221-U.	1,500	200-BP-3
216-B-52 Trench	Dec 1957-Jan 1958	Scavenged tributyl phosphate waste from 221-U.	8,530	200-BP-2
216-B-53A Trench	Oct 1965-Nov 1965	Waste from the 300 Area Hanford lab operations.	549	200-BP-2
216-B-53B Trench	Nov 1962-March 1963	Waste from the 300 Area Hanford lab Operations (321 Building).	15.1	200-BP-2

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
216-B-54 Trench	March 1963-Oct 1965	Waste from the 300 Area Hanford Laboratories operations.	999	200-BP-2
216-B-58 Trench	Nov 1965-June 1967	PNL waste from the 300 Area.	413	200-BP-2
216-B-63 Trench	March 1970-present/*active*	Effluent from 221-B, 225-B, and 271-B floor drains and chem sewer wastes.	7,220,000	200-BP-8
Septic Tanks and Associated Drain Fields				
2607-EB Septic Tank	1951-present/*active*	Sanitary wastewater and sewage.	NA	200-BP-7
2607-EH Septic Tank	1983-unknown	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EK Septic Tank	1980-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EM Septic Tank	1984-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EN Septic Tank	Pre 1980-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EO Septic Tank	Circa 1985-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EP Septic Tank	1984-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-EQ Septic Tank	1985-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-ER Septic Tank	Unknown-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-GF Septic Tank	Unknown	Sanitary wastewater and sewage.	NA	200-SS-1
2607-E1 Septic Tank	1970-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-E2 Septic Tank	Pre 1980-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-E3 Septic Tank	1944-present/*active*	Sanitary wastewater and sewage.	NA	200-BP-6
2607-E4 Septic Tank	1944-present/*active*	Sanitary wastewater and sewage.	NA	200-BP-6

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
2607-E7B Septic Tank	Unknown	Sanitary wastewater and sewage.	NA	200-SS-1
2607-E8 Septic Tank	1978-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
2607-E9 Septic Tank	1951-present/*active*	Sanitary wastewater and sewage.	NA	
2607-E11 Septic Tank	Circa 1985-present/*active*	Sanitary wastewater and sewage.	NA	200-SS-1
		Transfer Facilities, Diversion Boxes, and Pipelines		
241-B-151 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-7
241-B-152 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-7
241-B-153 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-7
241-B-154 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-5
241-B-252 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-7
241-BR-152 Diversion Box	1948-June 1984	Processing and decon wastes.	NA	200-BP-7
241-BX-153 Diversion Box	1948-June 1983	Processing and decon wastes.	NA	200-BP-7
241-BX-154 Diversion Box	1948-July 1985	Processing and decon wastes.	NA	200-BP-6
241-BX-155 Diversion Box	1948-June 1984	Processing and decon wastes.	NA	200-BP-6
241-BXR-151 Diversion Box	1948-June 1984	Processing and decon wastes.	NA	200-BP-7
241-BXR-152 Diversion Box	1948-June 1984	Processing and decon wastes.	NA	200-BP7
241-BXR-153 Diversion Box	1948-June 1984	Processing and decon wastes.	NA	200-BP-7
241-BYR-152 Diversion Box	1950-June 1984	Processing and decon wastes.	NA	200-BP-7
241-BYR-153 Diversion Box	1950-June 1984	Processing and decon wastes.	NA	200-BP-7

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
241-BYR-154 Diversion Box	1950-June 1984	Processing and decon wastes.	NA	200-BP-7
241-ER-151 Diversion Box	1945-present/*active*	Processing and decon wastes.	NA	200-BP-9
241-ER-152 Diversion Box	1945-present/*active*	Processing and decon wastes.	NA	200-BP-6
242-B-151 Diversion Box	1945-June 1984	Processing and decon wastes.	NA	200-BP-7
242 B-207 Waste Line	NA	Processing and decon wastes.	NA	200-BP-7
221 B-216-B Waste Line	NA	Processing and decon wastes.	NA	200-BP-5
221B-241-BX Waste Line 154	NA	Processing and decon wastes.	NA	200-BP-6
221B-241-B Waste Line	NA	Processing and decon wastes.	NA	200-BP-6
BCSA Crib Line Waste Line	NA	Processing and decon wastes.	NA	200-BP-6
		Basins		
207-B Retention Basin	April 1945-present/*active*	Process cooling water from equipment jackets in 221-B.	Not reported	200 BP-8
216 B-59/59B Retention Basin	Dec 1967 - present/*active*	Diverted cooling water from 221-B.	477	200-BP-5
216-B-64 Retention Basin	Never used	Never used.	0	200-BP-9
		Burial Sites		
284-E Powerhouse Ash Pit	1943-present/*active*	Ash from the 200 East Powerhouse.	63,000	200-SS-1
218-E-2 Burial Ground	1945-1953	Source unknown; contains MFP/TRU dry wastes.	9,033[a/] 9,056[b/]	200-BP-10
218-E-2A Burial Ground	1945-1955	Source unknown; also used as a storage site.	Unknown	200-BP-10

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
218-E-3 Burial Ground	1954	Source unknown; site exhumed.	NA	200-SS-1
218-E-4 Burial Ground	Feb 1955-1956	No trenches suspected; contaminated equipment was stored above ground.	1,586[a/] 1,587[b/]	200-BP-10
218-E-5 Burial Ground	1954-1956	Industrial mixed waste and small boxes. North end contains railroad boxcars contaminated with UNH.	3,172[a/] 3,115[b/]	200-BP-10
218-E-5A Burial Ground	1956-1959	Waste from L Cell (202-A burial package); four large boxes containing failed equipment and industrial wastes. D-2 Column from PUREX buried.	6,173[a/] 6,230[b/]	200-BP-10
218-E-6 Burial Ground	Fall 1955	Wooden shack and other items from 291-B stack area were placed in a trench and burned.	0	200-BP-6
218-E-7 Burial Ground	1947-1952	Lab and sample waste; mixed MFP/TRU wastes.	170[a/] 170[b/]	200-BP-6
218-E-9 Burial Ground	1953-1958	Storage site for fission product equipment contaminated in U recovery program at the tank farm.	unknown	2000-BP-10
218-E-10 Burial Ground	1960-present/*active*	Failed equipment and mixed industrial waste, PUREX cover and centrifuge blocks.	21,764[a/] 153,000[b/]	200-BP-10
200 East Area Construction Pit	1945-1955	Used as solid waste disposal site for construction debris.	NA	200-BP-9

Table 2-1. Summary of B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Years in Service/*Status*	Source Description	Waste Volume Received (m^3)	Operable Unit
200-E-8 Borrow Pit	1984-present/*active*	Site used to carry out thermal detonations for experimental purposes.	NA	200-BP-10

Notes:
[a] Source: WHC 1991a
[b] Source: Maxfield 1979
NA = No data available

Table 2-2. Description of B Plant Aggregate Area Tank Farms.

Name	Type	Integrity	Interim Stabilized	Isolation	Total Waste Volume (L)	Drainable Waste Volume (L)	High Ferrocyanide Content?
241-B Tank Farm							
241-B-101	Single-Shell	Assumed Leaker	Yes	Interim Isolated	427,676	22,709	No
241-B-102	Single-Shell	Sound	Yes	Interim Isolated	121,300	15,139	No
241-B-103	Single-Shell	Assumed Leaker	Yes	Interim Isolated	223,300	0	No[a]
241-B-104	Single-Shell	Sound	Yes	Interim Isolated	1,404,142	177,883	No
241-B-105	Single-Shell	Assumed Leaker	Yes	Interim Isolated	1,158,134	87,049	No
241-B-106	Single-Shell	Sound	Yes	Interim Isolated	442,816	26,493	No
241-B-107	Single-Shell	Assumed Leaker	Yes	Interim Isolated	624,484	49,202	No
241-B-108	Single-Shell	Sound	Yes	Interim Isolated	355,767	15,139	No
241-B-109	Single-Shell	Sound	Yes	Interim Isolated	480,663	30,278	No
241-B-110	Single-Shell	Assumed Leaker	Yes	Interim Isolated	931,049	87,049	No
241-B-111	Single-Shell	Assumed Leaker	Yes	Interim Isolated	896,986	83,265	No
241-B-112	Single-Shell	Assumed Leaker	Yes	Interim Isolated	124,897	11,354	No
241-B-201	Single-Shell	Assumed Leaker	Yes	Interim Isolated	109,758	15,139	No
241-B-202	Single-Shell	Sound	Yes	Interim Isolated	102,188	11,354	No
241-B-203	Single-Shell	Assumed Leaker	Yes	Interim Isolated	193,022	22,709	No
241-B-204	Single-Shell	Assumed Leaker	Yes	Interim Isolated	189,238	22,709	No
241-BX Tank Farm							
241-BX-101	Single-Shell	Assumed Leaker	Yes	Interim Isolated	162,774	3,785	No
241-BX-102	Single-Shell	Assumed Leaker	Yes	Interim Isolated	363,336	15,139	Yes

Table 2-2. Description of B Plant Aggregate Area Tank Farms. Page 2 of 3

Name	Type	Integrity	Interim Stabilized	Isolation	Total Waste Volume (L)	Drainable Waste Volume (L)	High Ferrocyanide Content?
241-BX-103	Single-Shell	Sound	Yes	Interim Isolated	249,794	15,139	No
241-BX-104	Single-Shell	Sound	Yes	Interim Isolated	374,690	124,897	No
241-BX-105	Single-Shell	Sound	Yes	Interim Isolated	193,022	41,632	No
241-BX-106	Single-Shell	Sound	No	Part. Interim Isolated	174,099	56,771	Yes
241-BX-107	Single-Shell	Sound	Yes	Part. Interim Isolated	1,305,739	113,543	No
241-BX-108	Single-Shell	Assumed Leaker	Yes	Interim Isolated	98,404	3,785	No
241-BX-109	Single-Shell	Sound	Yes	Part. Interim Isolated	730,457	49,202	No
241-BX-110	Single-Shell	Assumed Leaker	Yes	Part. Interim Isolated	753,165	79,480	Yes
241-BX-111	Single-Shell	Assumed Leaker	No	Part. Interim Isolated	870,492	261,148	Yes
241-BX-112	Single-Shell	Sound	Yes	Part. Interim Isolated	624,484	30,278	No
241-BY-Tank Farm							
241-BY-101	Single-Shell	Sound	Yes	Interim Isolated	1,464,689	18,924	Yes
241-BY-102	Single-Shell	Sound	No	Part. Interim Isolated	1,290,560	162,700	No
241-BY-103	Single-Shell	Assumed Leaker	No	Part. Interim Isolated	1,513,900	606,400	Yes
241-BY-104	Single-Shell	Sound	Yes	Interim Isolated	1,536,609	68,126	Yes
241-BY-105	Single-Shell	Assumed Leaker	No	Part. Interim Isolated	1,903,729	727,700	Yes
241-BY-106	Single-Shell	Assumed Leaker	No	Part. Interim Isolated	2,429,810	889,416	Yes
241-BY-107	Single-Shell	Assumed Leaker	Yes	Interim Isolated	1,006,744	94,619	Yes
241-BY-108	Single-Shell	Assumed Leaker	Yes	Interim Isolated	862,923	34,063	Yes
241-BY-109	Single-Shell	Sound	No	Part. Interim Isolated	1,600,949	264,600	No

Table 2-2. Description of B Plant Aggregate Area Tank Farms. Page 3 of 3

Name	Type	Integrity	Interim Stabilized	Isolation	Total Waste Volume (L)	Drainable Waste Volume (L)	High Ferrocyanide Content?
241-BY-110	Single-Shell	Sound	Yes	Interim Isolated	1,506,331	34,063	Yes
241-BY-111	Single-Shell	Sound	Yes	Interim Isolated	1,737,200	0	Yes
241-BY-112	Single-Shell	Sound	Yes	Interim Isolated	1,101,362	30,278	Yes

[a] Contains concentration of organic salts $\geq$10% (weight) TOC.

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a/]							
Waste Management Unit No.	Am-241	Co-60	Sr-90	Cs-137	Pu Total (grams)	Pu-238	Pu-239	Pu-240
200-E Ash Pit	--		--	--	--	--	--	--
207-B[b/]	--	--	--	--	--	--	--	--
2101-M	--	--	--	--	--	--	--	--
216-A-25	5.28E-04	--	2.57E+02	2.04E+02	4.28E+02	--	--	--
216-B-2-1[b/]	3.96E+00	--	1.01E+02	9.35E+01	2.50E+02	2.60E-03	7.99E-01	--
216-B-2-2[c/]	--	--	1.47E+02	3.14E-01	4.20E-02	--	2.40E-03[d/]	6.00E-04[d/]
216-B-2-3	--	--	4.32E+02	3.14E-01	--	--	--	--
216-B-3[e/]	3.96E+00	--	1.01E+02	9.35E+01	2.50E+02	2.60E-03	7.99E-01	--
216-B-3-1[b/]	--	--	--	--	--	--	--	--
216-B-3-2[c/]	--	--	--	--	--	--	--	--
216-B-3-3	--	--	--	--	--	--	--	--
216-B-3A	--	--	--	--	--	--	--	--
216-B-3B	--	--	--	--	--	--	--	--
216-B-3C	--	--	--	--	--	--	--	--
216-B-4[f/]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
216-B-10A	0.00E+00	9.90E-04[d/]	1.89E+00	4.01E-01	9.80E+00	0.00E+00	5.60E-01[d/]	1.51E-01[d/]
216-B-10B	0.00E+00	0.00E+00	2.00E-04	1.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
216-B-11A&B	0.00E+00	1.43E-03[d/]	2.01E+00	2.13E+01	4.00E+00	0.00E+00	2.28E-01[d/]	6.16E-02[d/]
216-B-12	0.00E+00	2.32E-01[d/]	7.93E+01	7.16E+02	3.74E+02	0.00E+00	2.14E+01[d/]	5.76E+00[d/]
216-B-13	--	--	--	--	--	--	--	--

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a/]							
Waste Management Unit No.	Am-241	Co-60	Sr-90	Cs-137	Pu Total (grams)	Pu-238	Pu-239	Pu-240
216-B-14	0.00E+00	1.03E-01[d/]	1.72E+02	1.14E+02	2.50E+01	0.00E+00	1.43E+00[d/]	3.85E-01[d/]
216-B-15	0.00E+00	1.09E-01[d/]	8.73E+01	9.24E+01	5.00E+00	0.00E+00	2.85E-01[d/]	7.70E-02[d/]
216-B-16	0.00E+00	1.03E-01[d/]	3.02E+02	2.96E+02	1.00E+01	0.00E+00	5.71E-01[d/]	1.54E-01[d/]
216-B-17	0.00E+00	2.04E-02[d/]	6.89E+01	1.00E+02	1.00E+01	0.00E+00	5.71E-01[d/]	1.54E-01[d/]
216-B-18	0.00E+00	1.03E-01[d/]	8.18E+01	1.14E+02	1.00E+01	0.00E+00	5.71E-01[d/]	1.54E-01[d/]
216-B-19	0.00E+00	1.17E-01[d/]	8.83E+01	1.26E+02	1.00E+01	0.00E+00	5.71E-01[d/]	1.54E-01[d/]
216-B-20	0.00E+00	8.99E-02[d/]	3.40E+02	6.84E+02	1.30E+00	0.00E+00	7.42E-02[d/]	2.00E-02[d/]
216-B-21	0.00E+00	1.33-01[d/]	3.18E+02	1.69E+02	1.03E+01	0.00E+00	5.80E-01[d/]	1.36E-01[d/]
216-B-22	0.00E+00	2.74E-01[d/]	1.76E+02	2.05E+01	2.60E+00	0.00E+00	1.48E-01[d/]	3.42E-02[d/]
216-B-23	0.00E+00	1.37E-01[d/]	6.25E+01	5.09E+01	1.80E+00	0.00E+00	1.02E-01[d/]	2.77E-02[d/]
216-B-24	0.00E+00	2.10E-01[d/]	7.80E+01	5.86E+01	7.70E+01	0.00E+00	4.40E-01[d/]	1.19E-01[d/]
216-B-25	0.00E+00	1.41E-01[d/]	8.83E+01	2.55E+01	2.00E+00	0.00E+00	1.14E-01[d/]	3.08E-01[d/]
216-B-26	0.00E+00	2.23E-01[d/]	4.75E+02	4.38E+02	2.50E+00	0.00E+00	1.43E-01[d/]	3.85E-01[d/]
216-B-27	0.00E+00	1.77E-01[d/]	2.63E+02	1.58E+01	7.00E+01	0.00E+00	4.00E-02[d/]	1.08E-02[d/]
216-B-28	0.00E+00	5.37E-02[d/]	4.95E+01	1.07E+01	5.60E+00	0.00E+00	3.20E-01[d/]	8.62E-02[d/]
216-B-29	0.00E+00	1.65E-01[d/]	8.48E+01	2.74E+01	1.10E+00	0.00E+00	6.28E-02[d/]	1.69E-02[d/]
216-B-30	0.00E+00	3.97E-02[d/]	2.65E+02	1.57E+03	2.10E+00	0.00E+00	1.20E-01[d/]	3.23E-02[d/]
216-B-32	0.00E+00	3.97E-02[d/]	1.13E+02	5.86E+01	2.60E+00	0.00E+00	1.48E-01[d/]	4.00E-02[d/]
216-B-33	0.00E+00	3.27E-02[d/]	1.81E+01	1.27E+02	1.18E+01	0.00E+00	6.74E-01[d/]	1.82E-01[d/]
216-B-34	0.00E+00	1.40E-02[d/]	1.81E+01	7.91E+00	5.70E+00	0.00E+00	3.25E-01[d/]	8.78E-02[d/]

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a/]							
Waste Management Unit No.	Am-241	Co-60	Sr-90	Cs-137	Pu Total (grams)	Pu-238	Pu-239	Pu-240
216-B-35	0.00E+00	4.70E-04[d/]	9.64E+01	1.85E+02	1.20E+00	0.00E+00	6.85E-02[d/]	1.85E-02[d/]
216-B-36	0.00E+00	1.10E-03[d/]	1.99E+02	3.36E+02	8.00E-01	0.00E+00	4.57E-02[d/]	1.23E-02[d/]
216-B-37	0.00E+00	1.57E-02[d/]	6.56E+00	1.35E+03	2.00E+00	0.00E+00	1.14E-01[d/]	3.08E-02[d/]
216-B-38	0.00E+00	9.40E-04[d/]	7.59E+02	2.21E+02	1.20E+00	0.00E+00	6.85E-02[d/]	1.85E-02[d/]
216-B-39	0.00E+00	1.48E-02[d/]	9.27E+00	1.92E+02	1.51E+00	0.00E+00	8.26E-02[d/]	2.32E-02[d/]
216-B-40	0.00E+00	3.10E-04[d/]	1.15E+02	1.53E+02	1.00E+00	0.00E+00	5.71E-02[d/]	1.54E-02[d/]
216-B-41	0.00E+00	1.60E-04[d/]	1.93E+01	3.86E+02	3.00E-01	0.00E+00	1.71E-02[d/]	4.62E-03[d/]
216-B-42	0.00E+00	1.79E-01[d/]	4.63E+02	4.27E+01	1.00E+01	0.00E+00	5.71E-02[d/]	1.54E-01[d/]
216-B-43	0.00E+00	1.57E-02[d/]	5.74E+02	1.30E+02	5.00E-01	0.00E+00	2.85E-02[d/]	7.70E-03[d/]
216-B-44	0.00E+00	8.48E-02[d/]	1.20E+03	3.09E+02	1.50E+01	0.00E+00	8.56E-01[d/]	2.31E-01[d/]
216-B-45	0.00E+00	8.99E-02[d/]	1.18E+03	6.66E+02	1.00E+01	0.00E+00	5.71E-01[d/]	1.54E-01[d/]
216-B-46	0.00E+00	8.99E-02[d/]	6.31E+02	8.89E+01	2.00E+01	0.00E+00	1.01E+03[d/]	3.08E-01[d/]
216-B-47	0.00E+00	1.79E-02[d/]	2.61E+02	6.66E+01	5.00E+00	0.00E+00	2.85E-01[d/]	7.66E-02[d/]
216-B-48	0.00E+00	1.79E-02[d/]	5.47E+02	2.00E+02	5.00E+00	0.00E+00	2.85E-01[d/]	7.70E-02[d/]
216-B-49	0.00E+00	8.99E-02[d/]	1.14E+03	1.82E+02	1.50E+01	0.00E+00	8.56E-01[d/]	2.31E-01[d/]
216-B-5	0.00E+00	0.00E+00	2.55E+01	2.92E+01	4.27E+03	0.00E+00	2.44E+02[d/]	6.57E+01[d/]
216-B-50	0.00E+00	2.83E-02[d/]	3.39E+00	5.12E+01	2.39E-01	0.00E+00	1.36E-02[d/]	3.68E-03[d/]
216-B-51	--	--	--	--	--	--	--	--
216-B-52	0.00E+00	1.13E-01[d/]	4.92E+00	1.60E+02	1.90E+01	0.00E+00	1.08E+00[d/]	2.93E-01[d/]
216-B-53A	0.00E+00	3.35E-02[d/]	5.38E-02	5.59E-02	1.00E+02	0.00E+00	5.71E+00[d/]	1.54E+00[d/]

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]							
Waste Management Unit No.	Am-241	Co-60	Sr-90	Cs-137	Pu Total (grams)	Pu-238	Pu-239	Pu-240
216-B-53B	0.00E+00	4.83E-02[d]	5.06E+00	3.70E+00	5.00E+00	0.00E+00	2.85E-01[d]	7.70E-02[d]
216-B-54	0.00E+00	5.90E-03[d]	5.25E-02	5.47E-02	5.00E+00	0.00E+00	2.85E-01[d]	7.70E-02[d]
216-B-55	3.80E-06	--	7.23E+00	1.37E+01	6.53E-01	0.00E+00	3.80E-06	0.00E+00
216-B-56	never used	--	--	--	--	--	--	--
216-B-57	0.00E+00	1.47E-02[d]	1.83E+00	2.26E+02	1.87E-01	0.00E+00	1.06E-02[d]	2.87E-03
216-B-58	0.00E+00	1.98E-01[d]	5.55E+00	4.40E+00	6.70E+00	0.00E+00	3.93E-01[d]	1.03E-01[d]
216-B-59	--	--	2.89E-02	1.20E-02	--	--	--	--
216-B-6[f]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
216-B-60	--	--	--	--	--	--	--	--
216-B-61	never used	--	--	--	--	--	--	--
216-B-62	1.03E-01	--	7.46E+01	1.35E+02	7.55E-01	--	2.30E-03[a]	--
216-B-63	3.48E-02	--	2.41E+00	6.25E-01	5.73E-01	--	1.08E-02	--
216-B-64	never used	--	--	--	--	--	--	--
216-B-7A&B	0.00E+00	1.20E-02[d]	2.20E+03	4.32E+01	4.30E+03	0.00E+00	2.46E+02[d]	6.62E+01[d]
216-B-8TF	0.00E+00	9.00E-03[d]	5.58E+00	1.98E+01	3.00E+01	0.00E+00	1.70E+00[d]	4.62E-01[d]
216-B-9TF	0.00E+00	9.00E-04[d]	5.52E+00	3.92E+00	1.74E+02	0.00E+00	9.94E+00[d]	2.68E+00[d]
216-E-28	--	--	--	--	--	--	--	--
216-N-8	--	--	--	--	--	--	--	--
218-E-2	--	--	1.87E+02	2.13E+02	8.00E+02	--	--	--
218-E-2A	--	--	--	--	--	--	--	--

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]							
Waste Management Unit No.	Am-241	Co-60	Sr-90	Cs-137	Pu Total (grams)	Pu-238	Pu-239	Pu-240
218-E-4	--	--	8.33E-02	9.40E+02	1.00E+01	--	--	--
218-E-5	--	--	6.27E+01	7.07E+01	6.20E+02	--	--	--
218-E-5A	--	--	1.47E+02	1.65E+02	1.38E+03	--	--	--
218-E-6	--	--	--	--	--	--	--	--
218-E-7	--	--	4.36E+00	4.96E+00	1.00E+00	--	--	--
218-E-10	--	2.47E+03[g]	7.68E+05[g]	9.31E+05[g]	4.90E+03	--	--	--

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]								
Waste Management Unit No.	Pu-241	Ru-106	Total U	H-3	Alpha	Beta	U-238	U-235	Volume Recorded (L)
207-B[b]	--	--	--	--	--	--	--	--	--
2101-M	--	--	--	--	--	--	--	--	--
216-A-25	--	1.62E-04	4.24E+00	2.13E+02	2.75E+01	9.39E+02	--	--	3.07E+11
216-B-2-1[b]	--	1.42E+00	2.10E+00	7.90E+02	1.62E+01	3.90E+02	--	--	1.49E+11
216-B-2-2[c]	0.00E+00	--	1.57E-05	0.00E+00	2.58E-03	2.95E+02	0.00E+00	0.00E+00	4.97E+07
216-B-2-3	--	--	--	--	--	8.64E+02	--	--	--
216-B-3[c]	--	1.42E+00	2.10E+00	7.90E+02	1.62E+01	3.90E+02	--	--	2.40E+11
216-B-3-1[b]	--	--	--	--	--	--	--	--	1.49E+11
216-B-3-2[c]	--	--	--	--	--	--	--	--	1.49E+11
216-B-3-3	--	--	--	--	--	--	--	--	--
216-B-3A	--	--	--	--	--	--	--	--	--
216-B-3B	--	--	--	--	--	--	--	--	--
216-B-3C	--	--	--	--	--	--	--	--	--
216-B-4[f]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00[d]	0.00E+00	0.00E+00	1.00E+04
216-B-10A	0.00E+00	0.00E+00	3.02E-03	0.00E+00	6.02E-01	4.55E+00	3.04E-03[d]	0.00E+00	9.99E+06
216-B-10B	0.00E+00	0.00E+00	2.49E-07	0.00E+00	2.91E-06	5.31E-07	0.00E+00	0.00E+00	2.80E+04
216-B-11A&B	0.00E+00	4.25E-01	4.54E-03	0.00E+00	2.46E-01	4.49E+01	4.56E-03[d]	0.00E+00	2.96E+07
216-B-12	0.00E+00	1.00E-04	6.96E+00	0.00E+00	2.30E+01	1.54E+03	7.00E+00[d]	0.00E+00	5.20E+08
216-B-13	--	--	--	--	--	--	--	--	2.10E+04
216-B-14	0.00E+00	0.00E+00	7.26E-02	0.00E+00	1.53E+00	5.67E+02	0.073[d]	0.00E+00	8.71E+06

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a/]								
Waste Management Unit No.	Pu-241	Ru-106	Total U	H-3	Alpha	Beta	U-238	U-235	Volume Recorded (L)
216-B-15	0.00E+00	0.00E+00	3.48E-02	0.00E+00	3.07E-01	3.57E+02	3.48E-02[d/]	0.00E+00	6.32E+06
216-B-16	0.00E+00	0.00E+00	1.07E-01	4.50E+02[d/]	6.14E-01	1.18E+03	1.08E-01[d/]	0.00E+00	5.60E+06
216-B-17	0.00E+00	0.00E+00	1.18E-01	0.00E+00	6.14E-01	3.30E+02	1.19E-01[d/]	0.00E+00	3.41E+06
216-B-18	0.00E+00	0.00E+00	7.86E-02	0.00E+00	6.14E-01	3.85E+02	7.91E-02[d/]	0.00E+00	8.52E+06
216-B-19	0.00E+00	0.00E+00	6.05E-02	0.00E+00	6.14E-01	4.18E+02	6.06E-02[d/]	0.00E+00	6.40E+06
216-B-20	0.00E+00	0.00E+00	1.17E-01	0.00E+00	7.98E-02	2.00E+03	1.18E-01[d/]	0.00E+00	4.68E+06
216-B-21	0.00E+00	0.00E+00	2.25E-01	0.00E+00	6.32E-01	9.65E+02	2.26E-01[d/]	0.00E+00	4.67E+06
216-B-22	0.00E+00	0.00E+00	1.39E-01	0.00E+00	1.60E-01	3.98E+02	1.40E-01[d/]	0.00E+00	4.74E+06
216-B-23	0.00E+00	0.00E+00	5.20E-02	0.00E+00	1.11E-01	2.26E+02	5.23E-02[d/]	0.00E+00	4.52E+06
216-B-24	0.00E+00	0.00E+00	8.20E-02	0.00E+00	4.73E-01	2.74E-01	8.25E-02[d/]	0.00E+00	4.70E+06
216-B-25	0.00E+00	0.00E+00	0.510E-02	0.00E+00	1.23E-01	2.29E+02	5.13E-01[d/]	0.00E+00	3.76E+06
216-B-26	0.00E+00	0.00E+00	1.96E-01	0.00E+00	1.53E-02	1.80E+03	1.97E-01[d/]	0.00E+00	5.88E+06
216-B-27	0.00E+00	0.00E+00	1.14E-01	0.00E+00	4.30E-02	5.60E+02	1.15E-01[d/]	0.00E+00	4.42E+06
216-B-28	0.00E+00	0.00E+00	1.00E-01	0.00E+00	3.40E-01	1.21E+02	1.01E-01[d/]	0.00E+00	5.05E+06
216-B-29	0.00E+00	0.00E+00	1.15E-01	0.00E+00	6.75E-02	2.26E+02	1.15E-01[d/]	0.00E+00	4.84E+06
216-B-30	0.00E+00	0.00E+00	2.93E-02	0.00E+00	1.29E-01	3.54E+03	2.95E-02[d/]	0.00E+00	4.78E+06
216-B-32	0.00E+00	0.00E+00	3.67E-03	0.00E+00	1.60E-01	3.39E+02	3.68E-03[d/]	0.00E+00	4.77E+06
216-B-33	0.00E+00	0.00E+00	6.67E-03	0.00E+00	7.24E-01	2.81E+02	6.70E-03[d/]	0.00E+00	4.74E+06
216-B-34	0.00E+00	0.00E+00	2.83E-02	0.00E+00	3.50E-01	5.17E+01	2.85E-02[d/]	0.00E+00	4.80E+06
216-B-35	0.00E+00	0.00E+00	5.57E-03	0.00E+00	7.37E-02	5.49E+02	5.59E-03[d/]	0.00E+00	1.06E+06

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]								
Waste Management Unit No.	Pu-241	Ru-106	Total U	H-3	Alpha	Beta	U-238	U-235	Volume Recorded (L)
216-B-36	0.00E+00	0.00E+00	5.32E-03	0.00E+00	4.91E-02	1.04E+03	5.32E-03[d]	0.00E+00	1.94E+06
216-B-37	0.00E+00	0.00E+00	1.21E-03	0.00E+00	1.23E-01	2.60E+03	1.21E-03[d]	0.00E+00	4.32E+06
216-B-38	0.00E+00	0.00E+00	1.41E-02	0.00E+00	7.37E-02	1.94E+03	1.42E-02[d]	0.00E+00	1.43E+06
216-B-39	0.00E+00	0.00E+00	1.93E-03	0.00E+00	9.27E-02	3.87E+02	1.94E-03[d]	0.00E+00	1.54E+06
216-B-40	0.00E+00	0.00E+00	1.70E-02	0.00E+00	6.14E-02	5.23E+02	1.17E-03[d]	0.00E+00	1.64E+06
216-B-41	0.00E+00	0.00E+00	2.50E-03	0.00E+00	1.84E-02	7.80E+02	2.51E-03[d]	0.00E+00	1.44E+06
216-B-42	0.00E+00	0.00E+00	2.27E-01	0.00E+00	6.14E-01	1.01E+03	2.28E-01[d]	0.00E+00	1.50E+06
216-B-43	0.00E+00	0.00E+00	4.54E-03	1.70E+02[d]	3.07E-02	1.40E+03	4.56E-03[d]	0.00E+00	2.12E+06
216-B-44	0.00E+00	0.00E+00	7.56E-04	4.50E+02[d]	9.21E-01	2.99E+03	7.60E-04[d]	0.00E+00	5.60E+06
216-B-45	0.00E+00	0.00E+00	2.27E-03	3.90E+02[d]	6.14E-01	3.64E+03	2.28E-03[d]	0.00E+00	4.92E+06
216-B-46	0.00E+00	0.00E+00	6.35E-02	5.36E+02[d]	1.23E+00	1.44E+03	6.36E-02	0.00E+00	6.70E+06
216-B-47	0.00E+00	0.00E+00	2.27E-03	0.00E+00	3.07E-01	6.50E+02	2.28E-03[d]	0.00E+00	3.71E+06
216-B-48	0.00E+00	0.00E+00	7.57E-04	3.27E+02[d]	3.07E-01	1.49E+03	7.60E-04[d]	0.00E+00	4.09E+06
216-B-49	0.00E+00	0.00E+00	1.06E-01	5.36E+02[d]	2.62E+02	2.36E+03	1.06E-01[d]	0.00E+00	6.70E+06
216-B-5	0.00E+00	1.03E-11	0.00E+00	0.00E+00	2.62E+02	1.08E+02	0.00E+00	0.00E+00	3.06E+07
216-B-50	0.00E+00	0.00E+00	9.50E-05	9.00E+01[d]	1.47E-02	1.05E+02	1.00E-04[d]	0.00E+00	5.48E+07
216-B-51	--	--	--	--	--	--	--	--	1.00E+03
216-B-52	0.00E+00	0.00E+00	9.98E-03	0.00E+00	1.17E+00	3.17E+02	1.00E-02[d]	0.00E+00	8.53E+06
216-B-53A	0.00E+00	0.00E+00	7.56E-03	0.00E+00	6.14E+00	2.46E-01	7.60E-02[d]	0.00E+00	5.49E+05
216-B-53B	0.00E+00	0.00E+00	3.02E-03	0.00E+00	3.07E+02	1.72E+01	3.03E-03[d]	0.00E+00	1.51E+04

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]								
Waste Management Unit No.	Pu-241	Ru-106	Total U	H-3	Alpha	Beta	U-238	U-235	Volume Recorded (L)
216-B-54	0.00E+00	0.00E+00	3.02E-03	0.00E+00	3.07E-01	9.45E-01	3.03E-3[d]	0.00E+00	9.99E+05
216-B-55	0.00E+00	5.01E-05	2.68E-02	2.68E+00	4.23E-02	4.09E+01	--	0.00E+00	1.23E+09
216-B-56	--	--	--	--	--	--	--	--	4.77E+05
216-B-57	0.00E+00	0.00E+00	2.97E-04	0.00E+00	1.15E-02	4.37E+02	2.90E-04[d]	0.00E+00	8.44E+07
216-B-58	0.00E+00	0.00E+00	3.04E-03	0.00E+00	4.11E-01	1.97E+01	3.05E-03[d]	0.00E+00	4.13E+05
216-B-59	--	--	--	--	--	8.32E-02	--	--	4.77E+05
216-B-6[f]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+01[d]	0.00E+00	0.00E+00	6.00E+06
216-B-60	--	--	--	--	--	--	--	--	1.89E+04
216-B-61	--	--	--	--	--	--	--	--	0.00E+00
216-B-62	--	4.90E-03	1.00E-02	1.47E+01	1.05E-01	4.18E+02	--	--	2.82E+08
216-B-63	--	2.39E-07	1.50E-01	2.12E+00	7.42E-02	6.32E+00	--	--	7.22E+09
216-B-64	--	--	--	--	--	--	--	--	--
216-B-7A&B	0.00E+00	0.00E+00	6.06E-02	0.00E+00	2.64E+02	4.49E+03	6.10E-02[d]	0.00E+00	4.36E+07
216-B-8TF	0.00E+00	0.00E+00	1.51E-02	0.00E+00	1.84E+00	4.93E+01	0.00E+00	0.00E+00	2.72E+07
216-B-9TF	0.00E+00	0.00E+00	1.51E-02	0.00E+00	1.07E+01	2.00E+00	1.52E-02[d]	0.00E+00	3.60E+07
216-E-28	--	--	--	--	--	--	--	--	--
216-N-8	--	--	--	--	--	--	--	--	unknown
218-E-2	--	0.00E+00	--	--	--	--	--	--	9.03E+03
218-E-2A	--	--	--	--	--	--	--	--	unknown
218-E-4	--	0.00E+00	--	--	--	--	--	--	1.59E+03

Table 2-3. Radionuclide Waste Inventory Summary.

	Quantity of Reported Radionuclides (Ci)[a]								
Waste Management Unit No.	Pu-241	Ru-106	Total U	H-3	Alpha	Beta	U-238	U-235	Volume Recorded (L)
218-E-5	--	0.00E+00	--	--	--	--	--	--	3.17E+03
218-E-5A	--	0.00E+00	--	--	--	--	--	--	6.17E+03
218-E-6	--	--	--	--	--	--	--	--	--
218-E-7	--	0.00E+00	--	--	--	--	--	--	1.70E+05
218-E-10	--	7.71E-01[g]	8.0E+05	--	--	4.3E+05[h]	--	--	21.7E+06

A dash (--) indicates where no inventory data were available.
[a] Values decayed through Dec 31, 1989 unless otherwise noted.
[b] WIDS states that inventory is included in the 216-B-3 Pond, but presents these values.
[c] Closed after UPR-200-E-138 released 1,000 Ci of Sr-90.
[d] Values are decayed through April 1, 1986.
[e] Unplanned releases UN-200-E-32, -34, and -138 contained approximately 21,000 Ci of activity.
[f] No inventory data is contained in WIDS, however, the presence of TRU fission products is mentioned. HISS shows low beta activity.
[g] Values decayed through December 31, 1990.
[h] Values as of September 30, 1978.

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$AlNO_3$	F	FeCN	H_2SO_4	HNO_3	K	Na	NaAl
216-B-7A&B	--	240,000	--	--	--	400,000	1,600,000	--
216-B-8TF	--	25,000	--	1,400,000	--	40,000	900,000	--
216-B-9TF	--	--	--	--	--	--	--	--
216-B-10A	--	--	--	--	1,000	--	--	--
216-B-10B	--	--	--	--	2	--	--	--
216-B-12	--	--	--	--	--	--	--	--
216-B-14	--	--	5,000	--	--	--	600,000	--
216-B-15	--	--	3,300	--	--	--	400,000	--
216-B-16	--	--	3,000	-	-	--	500,000	--
216-B-17	--	--	1,800	--	--	--	500,000	--
216-B-18	--	--	5,000	--	--	--	400,000	--
216-B-19	--	--	3,400	--	--	--	700,000	--
216-B-43	--	--	1,100	--	--	--	170,000	--
216-B-44	--	--	3,000	--	--	--	330,000	--
216-B-45	--	--	2,600	--	--	--	340,000	--
216-B-46	--	--	4,000	--	--	--	500,000	--
216-B-47	--	--	2,000	--	--	--	310,000	--
216-B-48	--	--	2,200	--	--	--	400,000	--

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$AlNO_3$	F	FeCN	H_2SO_4	HNO_3	K	Na	NaAl
216-B-49	--	--	4,000	--	--	--	600,000	--
216-B-50	--	--	--	--	--	--	500	--
216-B-55	--	--	--	--	--	--	--	--
216-B-56	--	--	--	--	--	--	--	--
216-B-57	--	--	--	--	--	--	--	--
216-B-60	--	--	--	--	--	--	--	--
216-B-61	--	--	--	--	--	--	--	--
216-B-62	--	--	--	--	--	--	--	--
216-B-13	--	--	--	--	--	--	--	--
216-B-51	--	--	--	--	--	--	80	--
216-B-4	--	--	--	--	1,000	--	--	--
216-B-5	5,000	50,000	--	--	--	80,000	--	--
216-B-6	--	--	--	10,000	10,000	--	--	--
216-B-11A&B	--	--	--	--	--	--	--	--
216-B-20	--	--	2,500	--	--	--	500,000	--
216-B-22	--	--	2,500	--	--	--	400,000	--
216-B-23	--	--	2,400	--	--	--	400,000	--
216-B-24	--	--	2,500	--	--	--	280,000	--

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$AlNO_3$	F	FeCN	H_2SO_4	HNO_3	K	Na	NaAl
216-B-25	--	--	2,000	--	--	--	220,000	--
216-B-26	--	--	3,100	--	--	--	350,000	--
216-B-27	--	--	2,300	--	--	--	260,000	--
216-B-28	--	--	2,700	--	--	--	400,000	--
216-B-29	--	--	2,600	--	--	--	280,000	--
216-B-30	--	--	2,500	--	--	--	500,000	--
216-B-31	--	--	2,500	--	--	--	500,000	--
216-B-32	--	--	2,500	--	--	--	500,000	--
216-B-33	--	--	2,500	--	--	--	700,000	--
216-B-34	--	--	2,600	--	--	--	800,000	--
216-B-35	--	2,600	--	--	--	--	60,000	10,000
216-B-36	--	5,000	--	--	--	--	120,000	24,000
216-B-37	--	50,000	--	--	--	--	1,300,000	250,000
216-B-38	--	4,000	--	--	--	--	90,000	18,000
216-B-39	--	4,000	--	--	--	--	90,000	18,000
216-B-40	--	4,000	--	--	--	--	100,000	20,000
216-B-41	--	4,000	--	--	--	--	90,000	18,000
216-B-42	--	--	800	--	--	--	90,000	--

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a/]							
	$AlNO_3$	F	FeCN	H_2SO_4	HNO_3	K	Na	NaAl
216-B-52	--	--	5,000	--	--	--	860,000	--
216-B-53A	--	--	--	--	--	--	--	--
216-B-53B	--	--	--	--	--	--	--	--
216-B-54	--	--	--	--	--	--	--	--
216-B-58	--	--	--	--	--	--	--	--

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$NaCr_2O_7$	NH_4CO_3	NH_4NO_3	NO_2	NO_3	Oxalate	PO_4	SO_4
216-B-7A&B	--	--	22,000	--	1,800,000	60,000	130,000	15,000
216-B-8TF	--	--	160,000	--	1,400,000	6,000	500,000	70,000
216-B-9TF	--	--	--	--	1,000	--	--	--
216-B-10A	100	--	--	--	1,000	--	--	1,000
216-B-10B	--	--	--	--	--	--	--	--
216-B-12	--	--	1,800,000	--	--	--	--	--
216-B-14	--	--	--	--	1,500,000	--	40,000	50,000
216-B-15	--	--	--	--	900,000	--	50,000	60,000
216-B-16	--	--	--	--	1,100,000	--	70,000	110,000
216-B-17	--	--	--	--	1,100,000	--	60,000	90,000
216-B-18	--	--	--	--	1,000,000	--	50,000	70,000
216-B-19	--	--	--	--	1,500,000	--	100,000	90,000
216-B-43	--	--	--	--	400,000	--	21,000	29,000
216-B-44	--	--	--	--	800,000	--	40,000	60,000
216-B-45	--	--	--	--	90,000	--	41,000	60,000
216-B-46	--	--	--	--	1,200,000	--	70,000	100,000
216-B-47	--	--	--	--	700,000	--	40,000	60,000
216-B-48	--	--	--	--	1,000,000	--	60,000	80,000

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$NaCr_2O_7$	NH_4CO_3	NH_4NO_3	NO_2	NO_3	Oxalate	PO_4	SO_4
216-B-49	--	--	--	--	1,500,000	--	60,000	80,000
216-B-50	--	9,100	10,000	--	1,500	--	--	--
216-B-55	--	--	90,000	--	--	--	--	--
216-B-56	--	--	--	--	--	--	--	--
216-B-57	--	12,000	--	--	--	--	--	--
216-B-60	--	--	--	--	--	--	--	--
216-B-61	--	--	--	--	--	--	--	--
216-B-62	--	--	--	--	--	--	--	--
216-B-13	--	--	--	--	2,000	--	--	--
216-B-51	--	--	--	--	190	--	8	11
216-B-4	--	--	--	--	--	--	--	--
216-B-5	--	--	--	--	400,000	12,000	29,000	3,300
216-B-6	100	--	--	--	--	--	--	--
216-B-11A&B	--	--	--	--	--	--	--	--
216-B-20	--	--	--	--	1,100,000	--	80,000	100,000
216-B-22	--	--	--	--	900,000	--	40,000	80,000
216-B-23	--	--	--	--	1,000,000	--	60,000	60,000
216-B-24	--	--	--	--	600,000	--	34,000	50,000

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$NaCr_2O_7$	NH_4CO_3	NH_4NO_3	NO_2	NO_3	Oxalate	PO_4	SO_4
216-B-25	--	--	--	--	500,000	--	27,000	40,000
216-B-26	--	--	--	--	800,000	--	40,000	60,000
216-B-27	--	--	--	--	600,000	--	32,000	50,000
216-B-28	--	--	--	--	1,000,000	--	50,000	80,000
216-B-29	--	--	--	--	700,000	--	35,000	50,000
216-B-30	--	--	--	--	1,100,000	--	70,000	110,000
216-B-31	--	--	--	--	1,100,000	--	60,000	90,000
216-B-32	--	--	--	--	1,000,000	--	60,000	90,000
216-B-33	--	--	--	--	1,700,000	--	100,000	110,000
216-B-34	--	--	--	--	1,900,000	--	80,000	90,000
216-B-35	--	--	--	10,000	90,000	--	20,000	4,000
216-B-36	--	--	--	18,000	160,000	--	40,000	8,000
216-B-37	--	--	--	200,000	1,700,000	--	400,000	90,000
216-B-38	--	--	--	13,000	120,000	--	27,000	6,000
216-B-39	--	--	--	14,000	120,000	--	29,000	6,000
216-B-40	--	--	--	15,000	130,000	--	31,000	7,000
216-B-41	--	--	--	13,000	120,000	--	27,000	6,000
216-B-42	--	--	--	--	210,000	--	11,000	150,000

Table 2-4. Chemical Waste Inventory Summary.

Waste Management Unit No.	Quantity of Reported Chemicals (kg)[a]							
	$NaCr_2O_7$	NH_4CO_3	NH_4NO_3	NO_2	NO_3	Oxalate	PO_4	SO_4
216-B-52	--	--	--	--	2,100,000	--	80,000	80,000
216-B-53A	--	--	--	--	1	--	--	--
216-B-53B	--	--	--	--	1	--	--	--
216-B-54	--	--	--	--	100	--	--	--
216-B-58	--	--	--	--	10	--	--	--

A dash (--) indicates where no inventory data was available.

[a] Not all sites have reported inventories. These inventories do not necessarily list all of the contaminants disposed of at a site.

Table 2-5. Partial Inventory of Radionuclides Disposed to the 218-E-2, -2A, -3, -4, -5, -5A, -6, -7, -9, and -10 Burial Grounds.

	U Grams	Pu Grams	^{90}Sr Ci	^{106}Ru Ci	^{137}Cs Ci
218-E-2[a/]	300,000	800	187.6	2.39E-09	213.1
218-E-2A[a/]	NA	NA	NA	NA	NA
218-E-3[a/]	NA	NA	NA	NA	NA
218-E-4[a/]	1,000	10	0.08328	1.5E-11	0.09402
218-E-5[a/]	12,000	620	62.66	9.92E-09	70.72
18-E-5A[a/]	120,000	1,380	147	1.4E-07	165.2
218-E-6[a/]	NA	NA	NA	NA	NA
218-E-7[a/]	1,000	1	5.89	1.16E-07	6.58
218-E-9[a/]	NA	NA	NA	NA	NA
218-E-10[a/]	800,000	4,900	7.68E+05	0.771	9.31E+05

a/ Source: WHC 1991a. Values decayed through December 31, 1990.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-1	Near 221-B Building 24 m (80 ft) from a June 17, 1946 line failure (UN-200-E-80). Waste line from 221-B Building to 241-BX-154 Diversion Box	Oct. 14, 1966	NA	• Soil contamination occurred from a waste line failure. Examination showed line failures in five lines installed in project C-112. Piping showed three areas of electrolytic corrosion. • Piping was removed and new pipe installed in V-shaped troughs with concrete covers. • This release is listed in the Tri-Party Agreement.
UN-200-E-2	Area around B Plant Stack	Nov. 18, 1947	291-B Stack	• Radioactive particle matter up to 1/32 inch found around the 291-B Stack. Further examination revealed a larger area of mist-like particles over a larger area. The exhaust fan inlet and outlet ducts were discovered as the reasons. • Stainless steel ducting, fans, CWS filters, and scrubbers installed to alleviate emissions. • HEPA filters installed in mid-1960's further reduced radionuclide concentrations. • Current emissions meet federal regulation limits. • Area around 291-B Stack is delimited by a light-weight chain barricade. • This release is listed in the Tri-Party Agreement.
UN-200-E-3	Waste line from 221-B Building to the 241-BX-154 Diversion Box	Nov. 21, 1951	NA	• Line failure contaminated the soil around the pipe to 120 R/h precluding failure investigation. Boreholes indicated the contamination limits. • Area posted with "Underground Radioactive Warning" signs. • PNL Hazard Ranking 1.09.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-7	Waste line from 221-B Building to the 241-B-361 Settling Tank near the 216-B-9 Crib and Tile Field	Nov. 30, 1954	NA	• A leak released approximately 19,000 L (5,000 gal) of cell wash water from 5-9 Tank. The dose rate was observed at 1.7 R/h. • The 216-B-9 Crib delimited with light-weight chain barricade. • PNL Hazard Ranking 1.45.
UN-200-E-9	216-BY-5 Flush Tank	Sept. 15, 1955	261-BY-5 Flush Tank	• 42,000 L (11,000 gal) of tributyl phosphate scavenged supernatant overflowed the 216-BY Flush Tank associated with the 216-B-43 Crib. • Contaminated soil excavated and placed in a pit south of the 216-B-43 Crib. • This release is listed in the Tri-Party Agreement.
UN-200-E-14	216-B-3 Pond	1958	216-B-3 Pond	• The 216-B-3 Pond dike broke allowing contaminated water to flow into a ravine east of the pond. • This release is listed in the Tri-Party Agreement.
UN-200-E-41	R-13 Stairwell of 271-B Building	July 19, 1972	271-B Building	• Line leak in a waste line contaminated the area with an estimated 30 Ci ^{137}Cs posting readings of 12.5 R/h. • Approximately 1/2 of the total Cs-137 was removed and buried. • This release is listed in the Tri-Party Agreement.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-43	Roadway from 241-BY Tank Farm to burial ground	Jan. 10, 1972	NA	• Liquid contained in 102-BY Pump being transported to burial. Counts of 1,000 to 100,000 ct/min were measured. • Cleanup decontamination began immediately. • PNL Hazard Ranking 1.04.
UN-200-E-44	BCS Crib line south of R-17 Change House	Aug. 16, 1972	NA	• Leak in the 15-cm (6-in.) BCS Crib line caused a cave in. The soil was contaminated to 10,000 to 20,000 ct/min. The pipe registered 20 mR/h. • No spread of contamination occurred. • This release is listed in the Tri-Party Agreement.
UN-200-E-45	241-B-154 Diversion Box	Aug. 26, 1974	241-B-154 Diversion Box	• Mixed waste at 50,000 ct/min flowed across 7th Avenue covering an area of 100 m (300 ft) long by 30 m (100 ft) wide. • The road was washed with water and the contaminated soil removed to a burial trench. • PNL Hazard Ranking 1.14.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-52	Soil and building adjacent and below the pressure relief valve from the E-5-2 strontium concentrator in the 221-B Building	Aug. 1, 1975	221-B Building	• The steam relief valve setting was lower than operating pressure allowing an escape that contaminated the 221-B Building side, the underlying soil, and the adjacent railroad berm. The radiation was measured from 20,000 to 100,000 ct/min. • The building side was cleaned, painted, and marked. • The contaminated soil was excavated, packaged, and buried. • No clean-up action was made to the railroad berm allowing radionuclide to be washed out with natural precipitation. • PNL Hazard Ranking 0.98.
UN-200-E-54	225-B Building	July 20, 1977	225-B Building	• 2 L (0.5 gal) of contaminated wash water seeped under a door contaminating the concrete pad and a 1 ft^3 of soil to radiation levels of 10,000 to 20,000 ct/min. • The soil was removed to a burial site. Signs were posted at the site. • PNL Hazard Ranking 1.04.
UN-200-E-55	Railway south of K-3 filter and gravel area southeast of 212-B Building	April 27, 1979	NA	• A temporary radiation zone established at surface radiation levels of 5,000 to 30,000 ct/min, presumably from wind-blown materials. • The area was cleaned and released from monitoring. • PNL Hazard Ranking 0.84.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-61	Railroad tracks adjacent to 200 East Area Burial Grounds	Oct. 31, 1981	NA	• The unloading ramp was identified as a site of an unplanned release with readings of 100,000 ct/min. Radioactive contamination of the ground resulted from burial operations. • The area was decontaminated to background levels. • The area is marked with a light-weight chain barricade.
UN-200-E-63	Contaminated vegetation in gravel pit outside of BY Trench Area	June 4, 1981	NA	• Vegetation absorbed radionuclides to 100,000 ct/min from the BY Cribs and then were blown to the gravel pit. • Vegetation was removed and a spraying program initiated to control future growth. • This release is listed in the Tri-Party Agreement.
UN-200-E-64	West of 216-B-64 Retention Basin	Oct. 12, 1984	216-B-64 Retention Basin	• Ants carried contaminated material with readings of 60,000 ct/min to the surface from the retention basin, consisting primarily of ^{137}Cs and ^{90}Sr. • The area is marked with light-weight chain barricades.
UN-200-E-69	221-B Railway Tunnel	June 19, 1984	221-B Building	• Flush water spilled from underneath a burial box being removed from a railcar leaving small spots of beta/gamma contamination up to 20,000 ct/min. • The area is contained behind a chain link fence with warning signs. • This release is listed in the Tri-Party Agreement.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-76	241-B-153 Diversion Box	Jan. 4, 1968	241-B-153 Diversion Box	• A line leak in the waste line from 9-2 Tank in the 221-B Building to the 241-B-110 Tank contaminated the soil with about 4,780 Ci of ^{144}Ce, 360 Ci of ^{106}Ru and 850 Ci of ^{95}Zr and niobium. • The release was covered with clean gravel. • PNL Hazard Ranking 0.98.
UN-200-E-79	Five areas between 242-B Evaporator and 207-B Retention Basin.	June 1953	NA	• Five leaks in the waste line allowed contamination of about 10 Ci of mixed fission waste products with radiation levels up to 2,500 ct/min. • It is assumed the area has been stabilized. • PNL Hazard Ranking 1.20.
UN-200-E-80	Underground waste line south of 221-B Building	June 17, 1946	NA	• An unknown amount leaked from an underground line creating a small depression having approximately 10 Ci of fission products. • The contaminated soil removed to a burial site, and was replaced with clean gravel. Approximately 5 Ci contaminants remain. • PNL Hazard Ranking 1.20.
UN-200-E-83	BC Controlled Area	1958 to 1989	10.4 km^2 (4 mi^2) area around BC Cribs and Trenches	• Contaminants injected into the area were spread by wildlife into the food chain and were exhibited by fecal droppings over a 1.5 km^2 (4 mi^2) area to a level of approximately 18 Ci of ^{90}Sr and 14 Ci of ^{137}Cs. • A burrow into the 216-B-28 Trench was discovered and asphalt capped. • The inactive trenches were filled with sand and gravel and capped with 15 cm (6 in.) of gravel, except trenches 216-B-20, -21, and -22.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-85	R-13 utility pit adjacent to 221-B Building	July 20, 1972	NA	• A suspected leak of the 18-1 waste line allowed 15 Ci of ^{137}Cs into the soil. • Cleanup actions were not reported. • PNL Hazard Ranking 1.14.
UN-200-E-87	South side of 221-B Building adjacent to 224-B Building	1945 ~ 1953	221-B Building	• Seepage from underground pipe joints into the soil. A 1975 radiological survey showed counts no greater than 200 ct/min. • Lightweight chain barricades surround the area. • PNL Hazard Ranking 1.04.
UN-200-E-89	Airborne contamination from 241-BX Tank Farm	~ 1978	241-BX Tank Farm, 241-BY Tank Farm	• An unplanned airborne release from the 241-BX Tank Farm allowed particulate matter to accumulate on the north side of Baltimore Avenue 8 m (25 ft) west of 216-B-57 Crib. • The road was overlaid with new asphalt. • PNL Hazard Ranking 1.36.
UN-200-E-90	Area surrounding 291-B Stack sand filter	Sept. 1980	291-B Stack	• High gamma dose rates discovered, presumably from the materials filtered by the systems. • Area adjacent to the filtration equipment delimited with light-weight chain barricades and signs. • This release is listed in the Tri-Party Agreement.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-92	East perimeter fence	1981	NA	• Over a period of time, Russian thistle has adsorbed contaminants which accumulated at the fence as a result of the gathered thistle decomposing there. • Contaminated sand was removed and clean sand replaced. The contaminated material was placed in a burial site north of the 216-A-24 Crib. • This release is listed in the Tri-Party Agreement.
UN-200-E-95	Railroad spur between 218-E-2A and 218-E-5	Sept. 1980	NA	• A series of small releases over time has accumulated to a higher level. • The most recent radiation levels were measured at 200 to 400 ct/min with spots to 4,000 ct/min. • This release is listed in the Tri-Party Agreement. • PNL Hazard Ranking 0.73.
UN-200-E-101	Area between 242-B Evaporator and 241-B Tank Farm fence	1986	NA	• An unknown amount of radionuclide contamination discovered in the weeds, possibly from airborne particulate emissions from the 241-B Tank Farm. • The contaminated weeds have been removed. • This release is listed in the Tri-Party Agreement.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-103	BCS Crib line south of R-17 change house	Mar. 8, 1972	221-B Building	• A line leak contaminated the soil to a surface detection level of up to 1,500 ct/min. • The leak was sealed and the area barricaded with a light-weight chain with posted signs. • This release is listed in the Tri-Party Agreement.
UN-200-E-105	107-BY Manifold Header in the 107-BY Tank Farm	Dec. 15, 1952	107-BY Tank Farm	• Approximately 87,000 L (23,000 gal) of first cycle liquid waste escaped from the header. • Area covered with concrete. • This release is listed in the Tri-Party Agreement • PNL Hazard Ranking 1.14.
UN-200-E-109	104-B Tank inside of the 241-B Tank Farm	Nov. 11, 1953	241-B Tank Farm	• About 570 L (150 gal) of concentrated tributyl phosphate waste was released from the tank in the 241-B Tank Farm contaminating about 300 ft^2 of soil with levels of 1 R/h. • The area was asphalt covered. • This release is listed in the Tri-Party Agreement. • PNL Hazard Ranking 1.04.
UN-200-E-110	241-BY-112 Tank at the 112-BY Pit	Aug. 7, 1955	241-BY-112 Tank	• 2,500 ft^2 of soil contaminated to a level of 22 R/h. • PNL Hazard Ranking 1.14.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UN-200-E-112	B Plant Aggregate Area Railroad Tunnel	Feb. 12, 1979	221-B Building	• During a canyon equipment burial transfer, some ion-exchange liquid spilled. The spilled liquid was carried out of the tunnel by the wheels, contaminating the rail from the 221-B Building to the east boundary of the burial ground. • The contamination was cleaned up immediately. • This release is listed in the Tri-Party Agreement. • PNL Hazard Ranking 0.82.
UN-200-E-140	221-B Bulk Storage Area	April 23, 1986	221-B Building	• Approximately 7.6 L (28.8 gal) of PCB contaminated oil spilled on the ground. Established as a Hazardous Waste Site. • The contaminated soil was removed and drummed for disposal. • This release is listed in the Tri-Party Agreement.
UPR-200-E-4	241-B-151 Diversion Box	Fall 1951	241-B-151 Diversion Box	• Leakage from the 241-B-151 Diversion Box contaminated the soil in the immediate vicinity to approximately 10 Ci. • Most of the contamination was removed and buried. The area was covered with 0.3 m (1 ft) of clean soil. • PNL Hazard Ranking 1.14.
UPR-200-E-5	241-BX-102 Tank	Mar. 20, 1951	241-BX-102 Tank	• Approximately 22.5 tons of soil was contaminated with depleted uranium from BX-102 Tank due to a plugged cascade outlet. • No clean-up action was reported. • PNL Hazard Ranking 1.20.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-6	241-B-153 Diversion Box	1954	241-B-153 Diversion Box	• Leakage from the 241-B-153 Diversion Box contaminated the soil in the immediate vicinity to approximately 1 Ci. • Most of the contamination was removed and buried. The area was covered with 0.3 m (1 ft) of clean soil. • PNL Hazard Ranking 1.09.
UPR-200-E-32	207-B Retention Basin and 216-B-2-1 Ditch	Nov. 7, 1963	216-B-2-1 Ditch and 207-B Retention Basin	• A coil leak in the 221-B Building contaminating the 4,900,000 L (1,300,000 gal) of primarily low-level cooling water discharged through the basin to the ditch. The primary ingredients were ^{144}Ce at 30 Ci and ^{90}Sr at 0.05 Ci. • The 216-B-2-1 Ditch was closed, backfilled, and stabilized. The 207-B Retention Basin walls were washed and covered with an asphalt-oil emulsion. Contaminated vegetation was removed and disposed. • Live tumbleweeds were found with readings of 2,000 ct/min. • PNL Hazard Ranking 1.09.
UPR-200-E-34	216-B-3-1 Ditch	June 1964	216-B-3-1 Ditch 216-A-25 Pond 216-B-3 Pond	• As a result of a coil leak at the F-15 PUREX Tank, an estimated 10,000 Ci of mixed fission products were released to 216-B-3-1 Ditch, 216-A-25 Pond, and 216-B-33 Pond. • The pond algae was killed and efforts were made to precipitate the fission products. The 216-B-3-1 Ditch was backfilled and replaced by the 216-B-3-2 Ditch.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-38	241-B-152 Diversion Box	Jan. 4, 1968	241-B-152 Diversion Box	• A fan-shaped area northeast of the 241-B-152 Diversion Box was contaminated. Ground readings of 2,000 to 6,000 ct/min were recorded. Local asphalt readings were 20 to 30 mR/h. • No clean-up actions were recorded.
UPR-200-E-51	216-B-3 Pond	May 1977	216-B-3-3 Ditch	• 15 kg of cadmium nitrate was released from PUREX Tank TK-324 to the 216-B-3 Pond and the 216-B-3-3 Ditch.
UPR-200-E-73	241-B-151 Diversion Box within 241-B Tank Farm	1951 ~ 1952	241-B-151 Diversion Box	• Leakage and spills contaminated the surrounding soil with approximately 10 Ci of fission products. • Most of the contamination was removed. The remaining contaminated soil was covered with 0.3 m (1 ft) of clean soil and the area delimited with a light-weight chain barricade and signs. • PNL Hazard Ranking 1.04.
UPR-200-E-74	Area around 241-B-152 Diversion Box	Spring 1954	241-B-152 Diversion Box	• This is a low activity release containing approximately 1 Ci in a 50 ft^2 area as contaminated with the diversion box in use. A 1975 radiological survey measured up to 30,000 ct/min. A portion of the contaminated soil was removed and buried. Several inches of clean soil was placed on top. The area was delimited with rope and signs. • PNL Hazard Ranking 1.04

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-75	Near 241-B-153 Diversion Box in southwest corner of 241-B Tank Farm	1954~1955	241-B-153 Diversion Box	• Work with the diversion box caused a general build-up to approximately 1 Ci of fission products. • Area covered with clean gravel and marked as a radiation zone. • PNL Hazard Ranking 1.09
UPR-200-E-77	241-B-154 Diversion Box	1946	241-B-154 Diversion Box	• Metal waste solution from the 221-B-Building with fission products measuring approximately 1 Ci contaminated the ground around the 241-B-154 Diversion Box as a result of a leaky jumper. • The site was stabilized, but re-contamination occurred. • 0.3 m (1 ft) of clean soil was placed on top. • PNL Hazard Ranking 1.09.
UPR-200-E-78	Area covered the 241-B-155 Diversion Box approximately 300 m (900 ft) south of 241-BX Tank Farm	Oct. 1955	241-BX-155 Diversion Box	• During pressure testing of lines and jumpers, a spill occurred causing the ground to be contaminated with approximately 10 Ci of mixed fission product salt waste. • The site is classified as a low activity site with general contamination to 150 ct/min and contact readings of 5mR/h on a riser. • The area is covered with clean soil. • PNL Hazard Ranking 1.04.
UPR-200-E-84	241-ER-311 Catch Tank	March 1953	241-ER-311 Catch Tank	• The Catch Tank leaked an estimated 6,500 L (1,700 gal) of acid contaminated with approximately 10 Ci of fission products. No surface contamination was detected. • No clean-up action was recorded.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-108	241-B-102 Heel Pit	Unknown	241-B-102 Single-Shell Tank	• Supernatant leak between the 241-B-102 and 241-B-101 Single-Shell Tanks with readings of 10 R/h. • Contaminated area was asphalt covered to reduce migration. • PNL Hazard Ranking 1.14.
UPR-200-E-116	241-BY-112 Pump	Nov. 20, 1972	241-BY-112 Single-Shell Tank	• An unknown volume of caustic flush water containing ^{137}Cs, ^{90}Y, ^{90}Sr sprayed from the pump. Radiation levels up to 3 R/h were measured 15 cm (6 in.) above the waste.
UPR-200-E-127	Soil surrounding 241-B-107 Single-Shell Tank	1968	241-B-107 Single-Shell Tank	• Approximately 30,000 L (8,000 gal) containing 2,000 Ci of ^{137}Cs leaked from the 241-B-110 Single-Shell Tank.
UPR-200-E-128	Soil surrounding 241-B-110 Single-Shell Tank	1969	241-B-110 Single-Shell Tank	• Approximately 31,000 L (8,300 gal) of waste containing 4,300 Ci of ^{137}Cs leaked from the 241-B-110 Single-Shell Tank.
UPR-200-E-129	241-B-201 Single-Shell Tank	1968	241-B-201 Single-Shell Tank	• Approximately 4,500 L (1,200 gal) of waste containing 420 Ci of ^{137}Cs leaked from 241-B-201 Single-Shell Tank to the soil underneath and around the tank. • The tank is an assumed leaker.
UPR-200-E-130	241-B-203 Single-Shell Tank	1951 ~ 1977	241-B-203 Single-Shell Tank	• Approximately 11,000 L (300 gal) of lanthanum fluoride escaped from the 241-B-203 Single-Shell Tank to the soil underneath and around the tank. • The tank is an assumed leaker.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-131	241-BX-102 Single-Shell Tank	1948 ~ 1971	241-BX-102 Single-Shell Tank	• A leak allowed 51,000 Ci of ^{137}Cs in a high-level, non-boiling liquid waste to contaminate approximately 31,000 ft^3 of soil to a depth of 40 m (120 ft). Groundwater may have been contaminated due to monitoring well installation at that location.
UPR-200-E-132	241-BX-102 Single-Shell Tank	1974	241-BX-102 Single-Shell Tank	• A leak in the tank allowed 9,500 L (2,500 gal) to contaminate the soil surrounding the tank with 500 Ci materials. • The soil was excavated and backfilled with clean soil.
UPR-200-E-133	241-BX-108 Single-Shell Tank	1949 ~ 1974	241-BX-108 Single-Shell Tank	• A tank leak allowed about 9,500 L (2,500 gal) of ^{137}Cs containing 500 Ci to contaminate the soil surrounding the tank.
UPR-200-E-134	241-BY-103 Single-Shell Tank	1973	241-BY-103 Single-Shell Tank	• 19,000 L (5,000 gal) of PUREX coating waste leaked from the 241-BY-103 Tank.
UPR-200-E-135	Soil around and under 241-BY-108 Single-Shell Tank	1955 ~ 1972	241-BY-108 Single-Shell Tank	• 19,000 L (5,000 gal) of tributyl phosphate waste leaked from the 241-BY-108 Tank. • A saltwater system has been installed.

Table 2-6. Description of Unplanned Releases.

Unplanned Release No.	Location	Date	Associated Waste Management Unit	Reported Waste-Related History
UPR-200-E-138	216-B-2-2 Ditch	Mar. 22, 1970	216-B-2-2 Ditch and 216-B-3-2 Ditch	• An estimated 1,000 Ci ^{90}Sr release during an operation with the product storage Tank 801 via a leaking manometer sensing line. The waste was washed to the floor drains which were directed to 216-B-2-2 Ditch bypassing the 207-B Retention Basin. The 216-B-2-2 Ditch received much of the material resulting in radiation levels of 500 R/h at 8 cm (3 in.) from the pipe gallery. • The 216-B-2-2 Ditch was decommissioned and backfilled with surface stabilization. • The 216-B-3-2 was also decontaminated and backfilled as a result of this unplanned release.
No Number	241-BX-103 Single-Shell Tank	1951	241-BX-103 Single-Shell Tank	• An estimated 100,000 to 300,000 L (30,000 to 90,000 gal) has overflowed and spilled to the ground between 241-BX-102 and 241-BX-103 Single-Shell Tanks in the vicinity of Dry Wells 21-0303, -05, and -12.

Table 2-7. Summary of Waste-Producing Processes in the B Plant Aggregate Area.

Process	Waste Generated	Major Chemical Constituents	Ionic Strength	pH	Organic Concentration	Radioactivity
Bismuth Phosphate	Process waste Aqueous process waste	nitric acid phosphoric acid nitrate solution uranium, plutonium	high	acidic (neutralized)	low	high
Lanthanum Fluroide	Process waste Aqueous process waste	plutonium sodium bismuthate phosphoric acid nitric acid hydrogen fluoride lanthanum salts	NA	NA	NA	high
Cesium and Strontium Recovery	Process waste Aqueous process waste	hydrochloric acid nitric acid phosphoric acid normal parafin hydrocarbon ammonium carbonate ammonium hydroxide	high	acidic (neutralized)	low	high
PUREX Wastes	Cladding waste Process waste	sodium hydroxide nitric acid tributyl phosphate parafin hydrocarbon nitrates	high low	acidic (neutralized)	low	high low
S Plant Wastes	Process waste Ion exchange waste	nitric acid sodium aluminate hexone uranium, plutonium	high	neutral/basic	low	high
284-E Powerhouse Wastes	Cooling water Water softener Scaling removal wastewater	sodium chloride EDTA sodium sulfite	high	neutral	low	none

Table 2-8. Chemicals Used in Separations/ Recovery Processes. Page 1 of 3

RADIONUCLIDES

Actinium-225
Actinium-227
Americium-241
Americium-242
Americium-242m
Americium-243
Antimony-126
Antimony-126m
Astitine-217
Barium-135m
Barium-137m
Barium-140
Bismuth-210
Bismuth-211
Bismuth-213
Bismuth-214
Carbon-14
Cerium-141
Cerium-144
Cesium-134
Cesium-135
Cesium-137
Cobalt-57
Cobalt-58
Cobalt-60
Curium-242
Curium-244
Curium-245
Europium-152
Europium-154
Europium-155
Francium-221
Francium-223
Iodine-129
Iron-59
Lanthanum-140
Lead-209
Lead-210
Lead-211
Lead-212
Lead-214
Manganese-54
Neptnium-237
Neptnium-239
Nickel-59
Nickel-63
Niobium-93m
Niobium-95
Palladium-107
Plutonium-238
Plutonium-239/240
Plutonium-241
Polonium-210
Polonium-213
Polonium-214
Polonium-215
Polonium-218
Potassium-40
Praeseodymium-144
Promethium-147
Protactinium-231
Protactinium-233
Protactinium-234m
Radium
Radium-223
Radium-225
Radium-226
Rhodium-103
Rhodium-106
Ruthenium-103
Ruthenium-106
Samarium-151
Selenium-79
Silver-110m
Sodium-22
Strontium-85
Strontium-89
Strontium-90
Technetium-99
Tellurium-129
Thallium-207
Thorium-227
Thorium-229
Thorium-230
Thorium-231
Thorium-233
Thorium-234
Tin-126
Tritium
Uranium-233
Uranium-234
Uranium-235
Uranium-238
Yttrium-90
Yttrium-91
Zinc-65
Zirconium-93
Zirconium-95

INORGANIC CHEMICALS

Acetic Acid[a/]
Alkaline liquids[a/b/c/d/]
Aluminum[a/c/d/]
Aluminum nitrate (mono basic)[a/]
Aluminum nitrate nonahydrate[a/c/]
Ammonia (anhydrous)[c/]
Ammonium carbonate[c/]
Ammonium fluoride[a/c/]
Ammonium hydroxide[c/]
Ammonium ion[d/]
Ammonium nitrate[a/c/d/]
Ammonium oxalate[a/]
Ammonium silicofluoride[c/]
Ammonium sulfate[c/]
Antifreeze[a/b/c/d/]
Arsenic[d/]
Barium[c/d/]
Barium nitrate[a/]
Beryllium[a/c/]
Bismuth[d/]
Bismuth nitrate[c/]
Bismuth phosphate[c/d/]
Boric acid[a/c/]
Boron[d/]
Cadmium[c/d/]
Cadmium nitrate[a/]
Calcium[c/d/]
Calcium carbonate[c/]
Calcium chloride[c/]
Carbon dioxide[c/]
Carbonate[c/d/]
Ceric fluroide[a/]
Ceric iodate[a/]
Ceric nitrate[c/]
Ceric sulfate[a/]
Cerium[c/]
Cesium carbonate[c/]
Cesium chloride[c/]
Chloride[c/]
Chromium[c/d/]
Chromiun nitrate[c/]
Chromous sulfate[a/]

Table 2-8. Chemicals Used in Separations/ Recovery Processes.

INORGANIC CHEMICALS (Continued)

Copper[c/d/]
Cyanide[c/d/]
DOW Anti-Foam B[a/]
Duolite ARC-359 (IX Resin) (sulfonated phenolic)[c/]
Ferric cyanide[c/d/]
Ferric nitrate[a/c/]
Ferrous sulfamate[a/]
Ferrous sulfate[a/c/]
Fluoride[c/d/]
Hydrobromic Acid[a/]
Hydrochloric acid[a/c/]
Hydrofluoric acid[a/]
Hydrogen[c/]
Hydrogen fluoride[c/]
Hydrogen peroxide[a/c/]
Hydroiodic acid[a/]
Hydroxide[d/]
Hydroxyacetic acid[a/c/]
Hydroxylamine hydrochloride[a/]
Iron[a/c/d/]
Lanthanum fluoride[a/]
Lanthanum hydroxide[a/]
Lanthanum nitrate[a/c/]
Lanthanum-neodynium nitrate[c/]
Lead[d/]
Lead nitrate[a/c/]
Lithium[d/]
Mangnesium[a/c/d/]
Mangnesium carbonate[c/]
Magnesium nitrate[c/]
Manganese[c/d/]
Mercuric nitrate[a/]
Mercury[c/]
Misc. Toxic Process Chemicals[b/]
Nickel[c/]
Nickel nitrate[a/c/]
Niobium[c/]
Nitrate[c/d/]
Nitric acid[a/c/d/]
Nitrite[c/d/]
Normal paraffin hydrocarbon[a/c/d/]
Oxalic acid[a/c/]
Periodic acid[a/]
Phosphate[c/d/]
Phosphoric acid[a/c/d/]
Phosphorous pentoxide[a/]
Phosphotungstic acid[c/]
Plutonium fluoride[c/]
Plutonium nitrate[c/]
Plutonium peroxide[c/]
Potassium[c/d/]
Potassium carbonate[a/]
Potassium ferrocyanide[c/]
Potassium fluoride[a/]
Potassium hydroxide[a/c]
Potassium oxalate[a/]
Potassium permanganate[a/c/]
Pu-Lanthanum fluoride[c/]
Pu-Lanthanum oxide[c/]
Rubidium[c/]
Silica[c/d/]
Silicon[a/c/d/]
Silver[c/d/]
Silver nitrate[a/c/]
Sodium[c/d/]
Sodium aluminate[c/]
Sodium bismuthate[c/]
Sodium bisulfate[c/a/]
Sodium bromate[a/]
Sodium carbonate[a/c/]
Sodium citrate[c/]
Sodium dichromate[a/b/c/d/]
Sodium ferrocyanide[a/]
Sodium fluoride[a/c/]
Sodium gluconate[c/]
Sodium hydroxide[a/b/c/d/]
Sodium nitrate[a/c/]
Sodium nitrite[a/c/]
Sodium persulfate[c/]
Sodium phosphate[c/]
Sodium sulfate[a/c/]
Sodium thiosulfate[a/]
Sodium thiosulfate[a/]
Strontium carbonate[c/]
Strontium fluoride[c/]
Strontium sulfate[c/]
Sugar[a/c/]
Sulfamic acid[a/d/]
Sulfate[c/d/]
Sulfuric acid[a/c/d/]
Tartaric acid[a/]
Thorium[d/]
Tin[d/]
Titanium[d/]
Uranium[c/d/]
Uranium oxide[d/]
Uranyl nitrate hexahydrate[d/]
Various acids[a/b/c/d/]
Yttrium[c/]
Zeolon[c/]
Zinc[c/d/]
Zirconium[a/c/]
Zirconyl nitrate[c/]

ORGANIC CHEMICALS

1-Butanol[c/]
1-Butanone[c/]
2-Butanone[c/]
Acetone[a/c/]
Ammonium[d/]
Bismuth phosphate[d/]
Butanoic acid[c/]
Butyl alcohol[c/d/]
Butylated hydroxy toluene[c/]
Carbon tetrachloride[a/]
Cesium phosphotungstic salts[c/]
Chloroform[c/d/]
Chloroplatinic Acid[a/]
Citric acid[c/]
Decane[c/d/]
Di2-Ethyl hexyl phosphoric acid[c/]
Dibutyl butyl phosphonate[a/]
Dibutyl phosphate[c/d/]
Dichloromethane[c/]
Diesel fuel[a/b/c/d/]
Dowex 21 K/Amberlite XE-270[a/]
Ethanol[a/c/]
Ethyl ether[a/]
Flammable solvents[a/b/c/d/]
Formaldehyde (Solution)[a/]
Grease[a/b/c/d/]
Halogenated hydrocarbons[a/b/c/d/]

Table 2-8. Chemicals Used in Separations/ Recovery Processes.

ORGANIC CHEMICALS (Continued)	Sodium acetate[c]
Hydroxy acetic acid-Trisodium hydroxy ethylene-Diamine-triaetic acid (THEDTA)[c]	Soltrol-170 ($C_{10}H_{22}$ to $C_{16}H_{34}$; purified kerosene[a]
Hydroxylamine nitrate[a]	Tartaric acid[c]
Ionac A-580/Permutit SK[a]	Tetrasodium ethylene diamine tetra-acetate (EDTA)[c]
Isopropyl alcohol[a]	Thenoyltrifluoroacetone[a]
Kerosene[c/d]	Toluene[c/e]
Methyl ethyl ketone[a/b/c/d]	Tri-n-dodecylamine[a]
Methylene chloride[c/e]	Tributyl phosphate[a/c/d]
Misc. Toxic Process Chemicals[a/b/c/d]	Trichloroethane[a/c/d]
Molybdate-citrate reagent[a]	Trichloromethane[c]
Monobutyl phosphate[c/d]	Trisodium hydroxyethyl Ethylene-diamine triacetate (HEDTA)[c]
Normal paraffin hydrocarbon[a/c]	Waste Paint and Thinners[a/b/c/d]
Paraffin hydrocarbons[c/d]	Zeolite AW-500 (IX Resin)[c]
PCBs[c]	
Propanol[c]	
Shell E-2342 (napthalene and paraffin)[a]	

Note: Not all analytes are reported in waste inventories. This list contains those chemicals know, or based on their association with B Plant processes, are suspected to have been disposed of to B Plant Aggregate Area waste management units.

a/ Chemicals used in PUREX processes
b/ Stored in Hazardous Waste Staging Areas
c/ Chemicals used in B Plant processes
d/ Chemicals used in U Plant processes
e/ Detected in 2101-M Pond sediment; thought to be cross-contamination sample in analyzing lab

Table 2-9. Radionuclides and Chemicals Disposed of to B Plant Waste Management Units. Page 1 of 3

RADIONUCLIDES

Actinium-225
Actinium-227
Americium-241
Americium-242
Americium-242m
Americium-243
Antimony-126
Antimony-126m
Astitine-217
Barium-135m
Barium-137m
Barium-140
Bismuth-210
Bismuth-211
Bismuth-213
Bismuth-214
Carbon-14
Cerium-141
Cerium-144
Cesium-134
Cesium-135
Cesium-137
Cobalt-57
Cobalt-58
Cobalt-60
Curium-242
Curium-244
Curium-245
Europium-152
Europium-154
Europium-155
Francium-221
Francium-223
Iodine-129
Iron-59
Lanthanum-140
Lead-209
Lead-210
Lead-211
Lead-212
Lead-214
Manganese-54
Neptnium-237
Neptnium-239
Nickel-59
Nickel-63
Niobium-93m
Niobium-95
Palladium-107
Plutonium-238
Plutonium-239/240
Plutonium-241
Polonium-210
Polonium-213
Polonium-214
Polonium-215
Polonium-218
Potassium-40
Praeseodymium-144
Promethium-147
Protactinium-231
Protactinium-233
Protactinium-234m
Radium
Radium-223
Radium-225
Radium-226
Rhodium-103
Rhodium-106
Ruthenium-103
Ruthenium-106
Samarium-151
Selenium-79
Silver-110m
Sodium-22
Strontium-85
Strontium-89
Strontium-90
Technetium-99
Tellurium-129
Thallium-207
Thorium-227
Thorium-229
Thorium-230
Thorium-231
Thorium-233
Thorium-234
Tin-126
Tritium
Uranium-233
Uranium-234
Uranium-235
Uranium-238
Yttrium-90
Yttrium-91
Zinc-65
Zirconium-93
Zirconium-95

INORGANIC CHEMICALS

Acetic Acid[a/]
Alkaline liquids[a/b/c/d/]
Aluminum[a/c/d/]
Aluminum nitrate (mono basic)[a/]
Aluminum nitrate nonahydrate[a/c/]
Ammonia (anhydrous)[c/]
Ammonium carbonate[c/]
Ammonium fluoride[a/c/]
Ammonium hydroxide[c/]
Ammonium ion[d/]
Ammonium nitrate[a/c/d/]
Ammonium oxalate[a/]
Ammonium silicofluoride[c/]
Ammonium sulfate[c/]
Arsenic[d/]
Barium[c/d/]
Barium nitrate[a/]
Beryllium[a/c/]
Bismuth[d/]
Bismuth nitrate[c/]
Bismuth phosphate[c/d/]
Boric acid[a/c/]
Boron[d/]
Cadmium[c/d/]
Cadmium nitrate[a/]
Calcium[c/d/]
Calcium carbonate[c/]
Calcium chloride[c/]
Carbon dioxide[c/]
Carbonate[c/d/]
Ceric fluroide[a/]
Ceric iodate[a/]
Ceric nitrate[c/]
Ceric sulfate[a/]
Cerium[c/]
Cesium carbonate[c/]
Cesium chloride[c/]
Chloride[c/]
Chromium[c/d/]
Chromiun nitrate[c/]
Chromous sulfate[a/]
Copper[c/d/]

Table 2-9. Radionuclides and Chemicals Disposed of to B Plant Waste Management Units. Page 2 of 3

INORGANIC CHEMICALS (Continued)

Cyanide[c/d/]
Ferric cyanide[c/d/]
Ferric nitrate[a/c/]
Ferrous sulfamate[a/]
Ferrous sulfate[a/c/]
Fluoride[c/d/]
Hydrochloric acid[a/c/]
Hydrofluoric acid[a/]
Hydrogen[c/]
Hydrogen fluoride[c/]
Hydrogen peroxide[a/c/]
Hydroiodic acid[a/]
Hydroxide[d/]
Hydroxyacetic acid[a/c/]
Hydroxylamine hydrochloride[a/]
Iron[a/c/d/]
Lanthanum fluoride[a/]
Lanthanum hydroxide[a/]
Lanthanum nitrate[a/c/]
Lanthanum-neodynium nitrate[c/]
Lead[d/]
Lead nitrate[a/c/]
Lithium[d/]
Mangnesium[a/c/d/]
Mangnesium carbonate[c/]
Magnesium nitrate[c/]
Manganese[c/d/]
Mercuric nitrate[a/]
Mercury[c/]
Misc. Toxic Process Chemicals[b/]
Nickel[c/]
Nickel nitrate[a/c/]
Niobium[c/]
Nitrate[c/d/]
Nitric acid[a/c/d/]
Nitrite[c/d/]
Normal paraffin hydrocarbon[a/c/d/]
Oxalic acid[a/c/]
Periodic acid[a/]
Phosphate[c/d/]
Phosphoric acid[a/c/d/]
Phosphorous pentoxide[a/]
Phosphotungstic acid[c/]
Plutonium fluoride[c/]
Plutonium nitrate[c/]
Plutonium peroxide[c/]
Potassium[c/d/]
Potassium carbonate[a/]
Potassium ferrocyanide[c/]
Potassium fluoride[a/]
Potassium hydroxide[a/c]
Potassium oxalate[a/]
Potassium permanganate[a/c/]
Pu-Lanthanum fluoride[c/]
Pu-Lanthanum oxide[c/]
Rubidium[c/]
Silica[c/d/]
Silicon[a/c/d/]
Silver[c/d/]
Silver nitrate[a/c/]
Sodium[c/d/]
Sodium aluminate[c/]
Sodium bismuthate[c/]
Sodium bisulfate[c/a/]
Sodium bromate[a/]
Sodium carbonate[a/c/]
Sodium chloride[f/]
Sodium citrate[c/]
Sodium dichromate[a/b/c/d/]
Sodium ferrocyanide[a/]
Sodium fluoride[a/c/]
Sodium gluconate[c/]
Sodium hydroxide[a/b/c/d/]
Sodium nitrate[a/c/]
Sodium nitrite[a/c/]
Sodium persulfate[c/]
Sodium phosphate[c/]
Sodium sulfate[a/c/]
Sodium sulfite[f/]
Sodium thiosulfate[a/]
Sodium thiosulfate[a/]
Strontium carbonate[c/]
Strontium fluoride[c/]
Strontium sulfate[c/]
Sugar[a/c/]
Sulfamic acid[a/d/]
Sulfate[c/d/]
Sulfuric acid[a/c/d/]
Tartaric acid[a/]
Thorium[d/]
Tin[d/]
Titanium[d/]
Uranium[c/d/]
Uranium oxide[d/]
Uranyl nitrate hexahydrate[d/]
Various acids[a/b/c/d/]
Yttrium[c/]
Zeolon[c/]
Zinc[c/d/]
Zirconium[a/c/]
Zirconyl nitrate[c/]

ORGANIC CHEMICALS

1-Butanol[c/]
1-Butanone[c/]
2-Butanone[c/]
Acetone[a/c/]
Ammonium[d/]
Bismuth phosphate[d/]
Butanoic acid[c/]
Butyl alcohol[c/d/]
Butylated hydroxy toluene[c/]
Carbon tetrachloride[a/]
Cesium phosphotungstic salts[c/]
Chloroform[c/d/]
Citric acid[c/]
Decane[c/d/]
Di2-Ethyl hexyl phosphoric acid[c/]
Dibutyl phosphate[c/d/]
Dichloromethane[c/]
Ethanol[a/c/]
Ethylene diamine tetra acetic acid[f/]
Halogenated hydrocarbons[a/b/c/d/]
Hydroxy acetic acid-Trisodium hydroxy ethylene-Diamine-triaetic acid (THEDTA)[c/]
Kerosene[c/d/]
Methyl ethyl ketone[a/b/c/d/]
Methylene chloride[c/e/]
Molybdate-citrate reagent[a/]
Monobutyl phosphate[c/d/]
Normal paraffin hydrocarbon[a/c/]

Table 2-9. Radionuclides and Chemicals Disposed of to B Plant Waste Management Units. Page 3 of 3

ORGANIC CHEMICALS (Continued)
Paraffin hydrocarbons[c/d/]
Propanol[c/]
Shell E-2342 (napthalene and paraffin)[a/]
Sodium acetate[c/]
Soltrol-170 ($C_{10}H_{22}$ to $C_{16}H_{34}$; purified kerosene[a/]
Tartaric acid[c/]
Tetrasodium ethylene diamine tetra-acetate (EDTA)[c/]
Thenoyltrifluoroacetone[a/]
Toluene[c/e/]
Tributyl phosphate[a/c/d/]
Trichloroethane[a/c/d/]
Trichloromethane[c/]
Trisodium hydroxyethyl Ethylene-diamine triacetate (HEDTA)[c/]

Note: Not all analytes are reported in waste inventories. This list contains those chemicals know, or based on their association with B Plant processes, are suspected to have been disposed of to B Plant Aggregate Area waste management units.

a/ Chemicals used in PUREX processes
b/ Stored in Hazardous Waste Staging Areas
c/ Chemicals used in B Plant processes
d/ Chemicals used in U Plant processes
e/ Detected in 2101-M Pond sediment; thought to be cross-contamination sample in analyzing lab
f/ From the 284-E Powerhouse water softening process

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3.0 SITE CONDITIONS

The following sections describe the physical nature and setting of the Hanford Site, the 200 East Area, and the B Plant Aggregate Area. The site conditions are presented in the following sections:

- Physiography and Topography (Section 3.1)
- Meteorology (Section 3.2)
- Surface Hydrology (Section 3.3)
- Geology (Section 3.4)
- Hydrogeology (Section 3.5)
- Environmental Resources (Section 3.6)
- Human Resources (Section 3.7).

Sections describing topography, geology, and hydrogeology have been taken from standardized texts provided by Westinghouse Hanford (Delaney et al. 1991 and Lindsey et al. 1992) for that purpose.

3.1 PHYSIOGRAPHY AND TOPOGRAPHY

The Hanford Site (Figure 3-1) is situated within the Pasco Basin of southcentral Washington. The Pasco Basin is one of a number of topographic depressions located within the Columbia Basin Subprovince of the Columbia Intermontane Province (Figure 3-2), a broad basin located between the Cascade Range and the Rocky Mountains. The Columbia Intermontane Province is the product of Miocene continental flood basalt volcanism and regional deformation that occurred over the past 17 million years. The Pasco Basin is bounded on the north by the Saddle Mountains, on the west by Umtanum Ridge, Yakima Ridge, and the Rattlesnake Hills, on the south by Rattlesnake Mountain and the Rattlesnake Hills, and on the east by the "Palouse" slope (Figure 3-1).

The physiography of the Hanford Site is dominated by the low-relief plains of the Central Plains physiographic region and anticlinal ridges of the Yakima Folds physiographic region (Figure 3-3). Surface topography seen at the Hanford Site is the result of (1) uplift of anticlinal ridges, (2) Pleistocene cataclysmic flooding, and (3) Holocene eolian activity (DOE 1988b). Uplift of the ridges began in the Miocene epoch and continues to the present. Cataclysmic flooding occurred when ice dams in western Montana and northern Idaho were breached, allowing large volumes of water to spill across eastern and central Washington. The last major flood occurred about 13,000 years ago, during the late Pleistocene Epoch. Anastomosing flood channels, giant current ripples, bergmounds, and giant flood bars are among the landforms created by the floods. Since the end of the Pleistocene Epoch, winds have locally reworked the flood sediments, depositing dune sands in the lower elevations and loess (windblown silt) around the margins of the Pasco Basin. Generally, sand dunes have been stabilized by anchoring vegetation except where they have been reactivated where vegetation is disturbed (Figure 3-4).

A series of numbered areas have been delineated at the Hanford Site. The 100 Areas are situated in the northern part of the Site adjacent to the Columbia River in an area commonly called the "Horn." The elevation of the "Horn" is between 119 and 143 m (390 and 470 ft) above mean sea level (msl) with a slight increase in elevation away from the river. The 200 Areas are situated on a broad flat area called the 200 Areas Plateau. The 200 Areas Plateau is near the center of the Hanford Site at an elevation of approximately 198 to 229 m (650 to 750 ft) above msl. The plateau decreases in elevation to the north, northwest, and east toward the Columbia River, and plateau escarpments have elevation changes of between 15 to 30 m (50 to 100 ft).

The 200 East Area is situated on the 200 Areas Plateau on a relatively flat prominent terrace (Cold Creek Bar) formed during the late Pleistocene flooding (Figure 3-5). Cold Creek Bar trends generally east to west and is bisected by a flood channel that trends north to south. This terrace drops off rather steeply to the north and northwest with elevation changes between 15 and 30 m (50 to 100 ft).

The topography of the 200 East Area is generally flat (Figure 3-1). The elevation in the vicinity of the B Plant Aggregate Area ranges from approximately 225 m (740 ft) in the southern part of the unit to about 133 m (435 ft) above msl in the northern part. A detailed topographic map of the area is provided as Plate 2. There are no natural surface drainage channels within the area.

3.2 METEOROLOGY

The following sections provide information on Hanford Site meteorology including precipitation (Section 3.2.1), wind conditions (Section 3.2.2), and temperature variability (Section 3.2.3).

The Hanford Site lies east of the Cascade Mountains and has a semiarid climate because of the rainshadow effect of the mountains. The weather is monitored at the Hanford Meteorology Station, located between the 200 East and 200 West Areas, and at other points situated through the reservation. The following sections summarize the Hanford Site meteorology.

3.2.1 Precipitation

The Hanford Site receives an annual average of 16 cm (6.3 in.) of precipitation. Precipitation falls mainly in the winter, with about half of the annual precipitation occurring between November and February. Average winter snowfall ranges from 13 cm (5.3 in.) in January to 0.8 cm (0.31 in.) in March. The record snowfall of 62 cm (24.4 in.) occurred in February 1916 (Stone et al. 1983). December through February snowfall accounts for about 38% of all precipitation in those months.

The average yearly relative humidity at the Hanford Site for 1946 to 1980 was 54.4%. Humidity is higher in winter than in summer. The monthly averages for the same period range from 32.2% for July to 80% in December. Atmospheric pressure averages are higher in the winter months and record absolute highs and lows also occur in the winter.

3.2.2 Winds

The Cascade Mountains have considerable effect on the wind regime at the Hanford Site by serving as a source of cold air drainage. This gravity drainage results in a northwest to west-northwest prevailing wind direction. The average mean monthly speed for 1945 to 1980 is 3.4 m/s (7.7 mph). Peak gust speeds range from 28 to 36 m/s (63 to 80 mph) and are generally southwest or west-southwest winds (Stone et al. 1983).

Figure 3-6 shows wind roses for the Hanford Telemetry Network (Stone et al. 1983). The gravity drainage from the Cascades produces a prevailing west-northwest wind in the 200 East Area. In July, hourly average wind speeds range from a low of 2.3 m/s (5.2 mph) from 9 to 10 a.m. to a high of 6 m/s (13.0 mph) from 9 to 10 p.m.

3.2.3 Temperature

Based on data from 1914 to 1980, minimum winter temperatures vary from -33 to -6 °C (-27 to +22 °F) and maximum summer temperatures vary from 38 to 46 °C (100 to 115 °F). Between 1914 and 1980, a total of 16 days with temperatures -29 °C (-20 °F) or below are recorded. There are 10 days of record when the maximum temperature failed to go above -18 °C (0 °F). Prior to 1980 there were three summers on record when the temperatures were 38 °C (100 °F) or above for 11 consecutive days (Stone et al. 1983).

3.3 SURFACE HYDROLOGY

3.3.1 Regional Surface Hydrology

Surface drainage enters the Pasco Basin from several other basins, which include the Yakima River Basin, Horse Heaven Basin, Walla Walla River Basin, "Palouse"/Snake Basin, and Big Bend Basin (Figure 3-7). Within the Pasco Basin, the Columbia River is joined by major tributaries including the Yakima, Snake, and Walla Walla Rivers. No perennial streams originate within the Pasco Basin. Columbia River inflow to the Pasco Basin is recorded at the United States Geological Survey gage below Priest Rapids Dam and outflow is recorded below McNary Dam. Average annual flow at these recording stations is approximately 1.1×10^{11} m^3 (8.7×10^7 acre-ft) at the United States Geological Survey gage and 1.6×10^{11} m^3 (1.3×10^8 acre-ft) at the McNary Dam gage (DOE 1988b).

Total estimated precipitation over the basin averages less than 15.8 cm/yr (6.2 in./yr). Mean annual runoff from the basin is estimated to be less than 3.1×10^7 m^3/yr (2.5×10^4 acre-ft/yr), or approximately 3% of the total precipitation. The remaining precipitation is assumed to be lost through evapotranspiration with a small component (perhaps less than 1%) recharging the groundwater system (DOE 1988b).

3.3.2 Surface Hydrology of the Hanford Site

Primary surface water features associated with the Hanford Site, located near the center of the Pasco Basin, are the Columbia and Yakima Rivers and their major tributaries, the Snake and Walla Walla Rivers. West Lake, about 4 hectares (10 acres) in size and less than 0.9 m (3 ft) deep, is the only natural lake within the Hanford Site (DOE 1988b). Wastewater ponds, cribs, and ditches associated with nuclear fuel reprocessing and waste disposal activities are also present on the Hanford Site.

The Columbia River flows through the northern part and along the eastern border of the Hanford Site. This section of the river, the Hanford Reach, extends from Priest Rapids Dam to the headwaters of Lake Wallula (the reservoir behind McNary Dam). Flow along the Hanford Reach is controlled by Priest Rapids Dam. Several drains and intakes are also present along this reach, including irrigation outfalls from the Columbia Basin Irrigation

Project, the Washington Public Power Supply System Nuclear Project 2, and Hanford Site intakes for onsite water use. Much of the northern and eastern parts of the Hanford Site are drained by the Columbia River.

Routine water quality monitoring of the Columbia River is conducted by the U.S. Department of Energy (DOE) for both radiological and nonradiological parameters and has been reported by Pacific Northwest Laboratory (PNL) since 1973. Washington State Department of Ecology (Ecology) has issued a Class A (excellent) quality designation for Columbia River water along the Hanford Reach from Grand Coulee Dam, through the Pasco Basin, to McNary Dam. This designation requires that all industrial uses of this water be compatible with other uses including drinking, wildlife habitat, and recreation. In general, the Columbia River water is characterized by a very low suspended load, a low nutrient content, and an absence of microbial contaminants (DOE 1988b).

Approximately one-third of the Hanford Site is drained by the Yakima River system. Cold Creek and its tributary, Dry Creek, are ephemeral streams on the Hanford Site that are within the Yakima River drainage system. Both streams drain areas along the western part of the Hanford Site and cross the southwestern part of the Hanford Site toward the Yakima River. Surface flow, which may occur during spring runoff or after heavier-than-normal precipitation, infiltrates and disappears into the surface sediments. Rattlesnake Springs, located on the western part of the Hanford Site, forms a small surface stream that flows for about 2.9 km (1.8 mi) before infiltrating into the ground.

3.3.3 B Plant Aggregate Area Surface Hydrology

One natural surface water body exists in the B Plant Aggregate Area. The 216-N-8 Pond (West Pond), located 1.2 km (0.75 mi) northeast of 216-A-25 (Gable Mountain Pond), is the only naturally occurring body of water found on the Hanford Site. Prior to the filling of Gable Mountain Pond, 216-N-8 Pond was an intermittent seasonal pond located in a natural basin at the base of Gable Mountain. After the introduction of large quantities of water to Gable Mountain Pond in 1957 the water table in the area was raised sufficiently to provide year-round water to the 216-N-8 Pond.

The existing manmade surface water bodies in the B Plant Aggregate Area are the 2101-M Pond, 216-B-3 Pond, 216-B-3A Pond, 216-B-3C Pond, 216-B-3-3 Ditch, 216-B-63 Ditch, and the 207-B Retention Basin. Figures 2-1 and 2-5 show the locations of these waste management units. The 2101-M Pond, located near the 200 East Area Powerhouse, receives small quantities of wastewater and generally contains less than 15 cm (6 in.) of standing water. Water dispersion takes place by evaporation and infiltration to the soil.

The 216-B-3 Pond (B Pond) is part of a cascading pond system that receives water from the 216-B-3-3 Ditch. This pond system consists of the 216-B-3 Pond, the 216-B-3A Pond, the 216-B-3B Lobe (currently inactive), and the 216-B-3C Lobe. The normal cascading flow for the system is from the 216-B-3 Pond to the 216-B-3A Pond, and finally to the 216-B-3C Lobe. Under abnormal circumstances, water can also be diverted to the 216-B-3B Lobe. The 216-B-3 Pond system is located 1,066 m (3,500 ft) east of the 200 East perimeter fence. Ongoing 216-B-3 Pond monitoring is discussed in Section 4.1.2.

The potential for flooding caused by overflow of the 216-B-3 Pond system to the surrounding area is minor because of the dike system surrounding the ponds, and also because water can be discharged from the 216-B-3A Pond to either the 216-B-3B or the 216-B-3C Lobes. If necessary, water can also be diverted to the 216-E-28 Contingency Pond located north of the 216-B-3 Pond system.

The 216-B-3A Pond, located south of the 216-B-3 Pond, receives water from the 216-B-3 Pond via the 216-B-352 overflow structure, and is separated from the other ponds in the system by a dike. The 216-B-3A Pond presents no threat of flooding due to the fact that water can be discharged to the 216-B-3B Pond (inactive) or to the 216-B-3C Pond via two water overflow structures. The last pond in the cascading series, the 216-B-3C Pond, receives overflow water from the 216-B-3A Pond. The Hanford soils, such as those beneath the 216-B-3C Pond, have historically demonstrated a high water infiltration rate. The 216-B-3C Pond is excavated into the surrounding soils so there is no possibility of an embankment failure. The high soil infiltration rate and the absence of embankment failure potential result in a low flooding potential.

The 216-B-3-3 Ditch, which originates just east of the 200 East Area perimeter fence, is fed by the 216-B-2 Pipeline and discharges to the 216-B-3 Pond system. The 216-B-3-3 Ditch is an open ditch that is posted as an area of surface contamination. Ongoing monitoring of the 216-B-3-3 Ditch is discussed in Section 4.1.2. The open portions of this ditch represent minor, if any, flooding potential due to the high bermed sides of the ditch and the nature of the soil, which allows for high infiltration of surface water.

The 216-B-63 Trench, located east of the 207-B Retention Basin, is a closed-end percolation ditch that receives chemical sewer water from the 221-B Building which then percolates into the soil column. Monitoring data for this ditch is presented in Section 4.1.2. The Hanford soils, such as those beneath the 216-B-63 Trench, have historically shown a high water infiltration rate. Data regarding the infiltration rate beneath the 216-B-63 Ditch is not sufficiently complete to allow the quantitative calculation of the infiltration rate. However, an infiltration rate comparable to other Hanford sites would result in a low potential for flooding.

The 207-B Retention Basin, located 610 m (2,000 ft) northeast of the 221-B Building, is a concrete-lined retention basin that receives cooling water from the 221-B Building and discharges to the 216-B-2 Pipeline. Possible flooding of the 207-B Retention Basin would be caused by plugging the 216-B-2 Pipeline resulting in the overflow of the basin. However, this scenario is unlikely, therefore, the flooding potential is low.

The 200 East Area, and specifically the B Plant Aggregate Area, is not in a designated floodplain. Calculations of probable maximum floods for the Columbia River and the Cold Creek Watershed indicate that the 200 East Area is not expected to be inundated under maximum flood conditions (DOE/RL 1991a).

3.4 GEOLOGY

The following sections provide information pertaining to geologic characteristics of southcentral Washington, the Hanford Site, the 200 East Area, and the B Plant Aggregate Area. Topics included are the regional tectonic framework (Section 3.4.1), regional stratigraphy (Section 3.4.2), and 200 East Area and B Plant Aggregate Area geology (Section 3.4.3).

The geologic characterization of the Hanford Site, including the 200 East Area and B Plant Aggregate Area is the result of many previous site investigation activities at Hanford. These activities include the siting of nuclear reactors, characterization activities for the Basalt Waste Isolation Project (BWIP), waste management activities, and related geologic studies supporting these efforts. Geologic investigations have included regional and Hanford Site surface mapping, borehole/well sediment logging, field and laboratory sediment classification, borehole geophysical studies (including gamma radiation logging), and in situ and laboratory hydrogeologic properties testing.

3.4.1 Regional Tectonic Framework

The following sections provide information on regional (southcentral Washington) geologic structure, structural geology of the Pasco Basin and the Hanford Site, and regional and Hanford Site seismology.

3.4.1.1 Regional Geologic Structure. The Columbia Plateau is a part of the North American continental plate and lies in a back-arc setting east of the Cascade Range. It is bounded on the north by the Okanogan Highlands, on the east by the Northern Rocky Mountains and Idaho Batholith, and on the south by the High Lava Plains and Snake River Plain (Figure 3-8).

The Columbia Plateau can be divided into three informal structural subprovinces (Figure 3-9): Blue Mountains, "Palouse", and Yakima Fold Belt (Tolan and Reidel 1989). These structural subprovinces are delineated on the basis of their structural fabric, unlike the physiographic provinces that are defined on the basis of landforms. The Hanford Site is located in the Yakima Fold Belt Subprovince near its junction with the "Palouse" Subprovinces.

The principal characteristics of the Yakima Fold Belt (Figure 3-10) are a series of segmented, narrow, asymmetric anticlines that have wavelengths between 5 and 32 km (3 and 19 mi) and amplitudes commonly less than 1 km (0.6 mi) (Reidel 1984; Reidel et al. 1989a). The northern limbs of the anticlines generally dip steeply to the north, are vertical, or even overturned. The southern limbs generally dip at relatively shallow angles to the south. Thrust or high-angle reverse faults with fault planes that strike parallel or subparallel to the axial trends are principally found on the north sides of these anticlines. The amount of vertical stratigraphy offset associated with these faults varies but commonly exceeds hundreds of meters. These anticlinal ridges are separated by broad synclines or basins that, in many cases, contain thick accumulations of Neogene- to Quaternary-age sediments. The Pasco Basin is one of the larger structural basins in the Yakima Fold Belt Subprovince.

Deformation of the Yakima folds occurred under a north-south compression and was contemporaneous with the eruption of the basalt flows (Reidel 1984; Reidel et al. 1989a). Deformation occurred during the eruption of the Columbia River Basalt Group and continued through the Pliocene Epoch, into the Pleistocene Epoch, and perhaps to the present.

3.4.1.2 Pasco Basin and Hanford Site Structural Geology. The Pasco Basin, in which the Hanford Site is located, is a structural depression bounded on the north by the Saddle Mountains anticline, on the west by the Umtanum Ridge, Yakima Ridge, and Rattlesnake Hills anticlines, and on the south by the Rattlesnake Mountain anticline (Figure 3-11). The Pasco Basin is divided into the Wahluke syncline on the north, and Cold Creek syncline on the south, by the Gable Mountain anticline, the easternmost extension of the Umtanum Ridge anticline. The Cold Creek syncline is bounded on the south by the Yakima Ridge anticline. Both the Cold Creek and Wahluke synclines are asymmetric and relatively flat-bottomed structures. The north limbs of both synclines dip gently (approximately 5°) to the south and the south limbs dip steeply to the north. The deepest parts of the Cold Creek syncline, the Wye Barricade depression, and the Cold Creek depression are approximately 12 km (7.5 mi) southeast of the Hanford Site 200 Areas, and to the west-southwest of the 200 East Area, respectively. The deepest part of the Wahluke syncline lies just north of Gable Gap.

The 200 East Area is situated on the generally southward dipping north limb of the Cold Creek syncline 1 to 5 km (0.6 to 3 mi) north of the syncline axis. The Gable Mountain-Gable Butte segment of the Umtanum Ridge anticline lies approximately 4 km (2.5

mi) north of the 200 West Area. The axes of the anticline and syncline are separated by a distance of 9 to 10 km (5.6 to 6.2 mi) and the crest of the anticline (as now exposed) is over 200 m (656 ft) higher than the uppermost basalt layer in the syncline axis. As a result, the basalts and overlying sediments dip to the south and southwest beneath the 200 East Area.

3.4.1.3 Regional and Hanford Site Seismology. Eastern Washington, especially the Columbia Plateau region, is a seismically inactive area when compared to the rest of the western United States (DOE 1988b). The historic seismic record for eastern Washington began in approximately 1850, and no earthquakes large enough to be felt had epicenters on the Hanford Site. The closest regions of historic moderate-to-large earthquake generation are in western Washington and Oregon and western Montana and eastern Idaho. The most significant event relative to the Hanford Site is the 1936 Milton-Freewater, Oregon, earthquake that had a magnitude of 5.75 and that occurred more than 90 km (54 mi) away. The largest Modified Mercalli Intensity for this event was felt about 105 km (63 mi) from the Hanford site at Walla Walla, Washington, and was VII.

Geologic evidence of past moderate or possibly large earthquake activity is shown by the anticlinal folds and faulting associated with Rattlesnake Mountain, Saddle Mountain, and Gable Mountain. The currently recorded seismic activity related to these structures consists of micro-size earthquakes. The suggested recurrence rates of moderate and larger-size earthquakes on and near the Hanford Site are measured in geologic time (tens of thousands of years).

3.4.2 Regional Stratigraphy

The following sections summarize regional stratigraphic characteristics of the Columbia River Basalt and Suprabasalt sediments. Specific references to the Hanford Site and 200 East Area are made where applicable to describe the general occurrence of these units within the Pasco Basin.

The principal geologic units within the Pasco Basin include the Miocene age basalt of the Columbia River Basalt Group, and overlying late Miocene to Pleistocene suprabasalt sediments (Figure 3-12). Older Cenozoic sedimentary and volcaniclastic rocks underlying the basalts are not exposed at the surface near the Hanford Site. The basalts and sediments thicken into the Pasco Basin and generally reach maximum thicknesses in the Cold Creek syncline. The sedimentary sequence at the Hanford Site is up to approximately 230 m (750 ft) thick in the west-central Cold Creek syncline, but pinches out against the anticlinal structures of Saddle Mountains, Gable Mountain/Umtanum Ridge, Yakima Ridge, and Rattlesnake Hills.

The suprabasalt sediments are dominated by laterally extensive deposits assigned to the late Miocene- to Pliocene-age Ringold Formation and the Pleistocene-age Hanford formation (Figure 3-13). Locally occurring strata described as pre-Missoula gravels, a discontinuous Plio-Pleistocene unit, and early "Palouse" soil comprise the remainder of the sedimentary sequence. The pre-Missoula gravels underlie the Hanford formation in the east-central Cold Creek syncline and at the east end of Gable Mountain anticline east and south of 200 East Area. The pre-Missoula gravels have not been identified in the 200 East Area. The nature of the contact between the pre-Missoula gravels and the overlying Hanford formation has not been completely delineated, based on available subsurface data. In addition, it is unclear whether the pre-Missoula gravels overlie or interfinger with the early "Palouse" soil and Plio-Pleistocene unit. Magnetic polarity data indicate the unit is no younger than early Pleistocene in age (>1 Ma) as reported in Lindsey et al. (1991).

Relatively thin surficial deposits of eolian sand, loess, alluvium, and colluvium discontinuously overlie the Hanford formation.

3.4.2.1 Columbia River Basalt Group. The Columbia River Basalt Group (Figure 3-12) comprises an assemblage of tholeiitic, continental flood basalts of Miocene age. These flows cover an area of more than 163,700 km^2 (63,000 mi^2) in Washington, Oregon, and Idaho and have an estimated volume of about 174,356 km^3 (40,800 mi^3) (Tolan and Reidel 1989). Isotopic age determinations indicate that basalt flows were erupted approximately 17 to 6 Ma (million years before present), with more than 98% by volume being erupted in a 2.5 million year period (17 to 14.5 Ma) (Reidel et al. 1989b).

Columbia River basalt flows were erupted from north-northwest-trending fissures or linear vent systems in north-central and northeastern Oregon, eastern Washington, and western Idaho (Swanson et al. 1979). The Columbia River Basalt Group is formally divided into five formations (from oldest to youngest): Imnaha Basalt, Picture Gorge Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt. Of these, only the Picture Gorge Basalt is not known to be present in the Pasco Basin. The Saddle Mountains Basalt, divided into the Ice Harbor, Elephant Mountain, Pomona, Esquatzel, Asotin, Wilbur Creek and Umatilla Members (Figure 3-12), forms the uppermost basalt unit throughout most of the Pasco Basin. The Elephant Mountain Member is the uppermost unit beneath most of the Hanford Site except near the 300 Area where the Ice Harbor Member is found and north of the 200 Areas where the Saddle Mountains Basalt has been eroded down to the Umatilla Member locally. On anticlinal ridges bounding the Pasco Basin, erosion has removed the Saddle Mountains Basalt, exposing the Wanapum and Grande Ronde Basalts.

3.4.2.2 Ellensburg Formation. The Ellensburg Formation consists of all sedimentary units that occur between the basalt flows of the Columbia River Basalt Group in the central Columbia Basin (Reidel and Fecht 1981; Smith et al. 1989). The Ellensburg Formation generally displays two main lithologies: volcaniclastics, and siliciclastics. The volcaniclastics consist mainly of primary pyroclastic air fall deposits and reworked epiclastics derived from volcanic terrains west of the Columbia Plateau. Siliciclastic strata in the Ellensburg Formation consists of reworked clastic, plutonic, and metamorphic detritus derived from the Rocky Mountain terrain. These two lithologies occur as both distinct and mixed in the Pasco Basin. A detailed discussion of the Ellensburg Formation in the Hanford Site is given by Reidel and Fecht (1981). Smith et al. (1989) provide a discussion of age equivalent units adjacent to the Columbia Plateau.

The stratigraphic names for individual units of the Ellensburg Formation are given in Figure 3-12. The nomenclature for these units is based on the upper- and lower-bounding basalt flows and thus the names are valid only for those areas where the bounding basalt flows occur. Because the Pasco Basin is an area where most bounding flows occur, the names given in Figure 3-12 are applicable to the Hanford Site. At the Hanford Site the three uppermost units of the Ellensburg Formation are the Selah interbed, the Rattlesnake Ridge interbed, and the Levey interbed.

3.4.2.2.1 Selah Interbed. The Selah interbed is bounded on the top by the Pomona Member and on the bottom by the Esquatzel Member. The interbed is a variable mixture of silty to sandy vitric tuff, arkosic sands, tuffaceous clays, and locally thin stringers of predominantly basaltic gravels. The Selah interbed is found beneath most of the Hanford Site.

3.4.2.2.2 Rattlesnake Ridge Interbed. The Rattlesnake Ridge interbed is bounded on the top of the Elephant Mountain Member and on the bottom by the Pomona Member. The interbed is up to 33 m (108 ft) thick and dominated by three facies at the Hanford Site: (1) a lower clay or tuffaceous sandstone, (2) a middle, micaceous-arkosic and/or tuffaceous sandstone, and (3) an upper, tuffaceous siltstone to sandstone. The unit is found beneath most of the Hanford Site.

3.4.2.2.3 Levey Interbed. The Levey interbed is the uppermost unit of the Ellensburg Formation and occurs between the Ice Harbor Member and the Elephant Mountain Member. It is confined to the vicinity of the 300 Area. The Levey interbed is a tuffaceous sandstone along its northern edge and a fine-grained tuffaceous siltstone to sandstone along its western and southern margins.

3.4.2.3 Ringold Formation. The Ringold Formation at the Hanford Site is up to 185 m (607 ft) thick in the deepest part of the Cold Creek syncline south of the 200 West Area and 170 m (558 ft) thick in the western Wahluke syncline near the 100-B Area. The Ringold Formation pinches out against the Gable Mountain, Yakima Ridge, Saddle Mountains, and Rattlesnake Mountain anticlines. It is largely absent in the northern and northeastern parts of the 200 East Area and adjacent areas to the north in the vicinity of West Pond. The Ringold Formation is assigned a late Miocene to Pliocene age (Fecht et al. 1987; DOE 1988b) and was deposited in alluvial and lacustrine environments (Bjornstad 1985; Fecht et al. 1987; Lindsay 1991).

Recent studies of the Ringold Formation (Lindsey and Gaylord 1989; Lindsey et al. 1992) indicate that it is best described and divided on the basis of sediment facies associations and their distribution. Facies associations in the Ringold Formation (defined on the basis of lithology, petrology, stratification, and pedogenic alteration) include fluvial gravel, fluvial sand, overbank deposits, lacustrine deposits, and alluvial fan. The facies associations are summarized as follows:

- Fluvial gravel--Clast-supported granule to cobble gravel with a sandy matrix dominates the association. Intercalated sands and muds also are found. Clast composition is very variable, with common types being basalt, quartzite, porphyritic volcanics, and greenstones. Silicic plutonic rocks, gneisses, and volcanic breccias also are found. Sands in this association are generally quartzo-feldspathic, with basalt contents generally in the range of 5 to 25%. Low angle to planar stratification, massive bedding, wide shallow channels, and large-scale cross-bedding are found in outcrops. The association was deposited in a gravelly fluvial system characterized by wide, shallow shifting channels.

- Fluvial sand--Quartzo-feldspathic sands displaying cross-bedding and cross-lamination in outcrop dominate this association. These sands usually contain less than 15% basalt lithic fragments, although basalt contents as high as 50% may be encountered. Intercalated strata consist of lenticular silty sands and clays up to 3 m (10 ft) thick and thin (<0.5 m) gravels. Fining upwards sequences less than 1 m (3.3 ft) to several meters thick are common in the association. Strata comprising the association were deposited in wide, shallow channels.

- Overbank deposits--This association dominantly consists of laminated to massive silt, silty fine-gained sand, and paleosols containing variable amounts of pedogenic calcium carbonate. Overbank deposits occur as thin lenticular interbeds (<0.5 m to 2 m (1.6 ft to 6 ft)) in the fluvial ground and fluvial sand associations and as thick (up to 10 m (33 ft)) laterally continuous sequences. These sediments record deposition in a floodplain under proximal levee to more distal floodplain conditions.

- Lacustrine deposits--Plane laminated to massive clay with thin silt and silty sand interbeds displaying some soft-sediment deformation characterize this association. These basaltic deposits are generally found around the periphery of the basins. Coarsening upwards packages less than 1 m (3.3 ft) to 10 m (33 ft) thick are common in the association. Strata comprising the association were deposited in a lake under standing water to deltaic conditions.

- Alluvial fan--Massive to crudely stratified, weathered to unweathered basaltic detritus dominates this association. This association was deposited largely by debris flows in alluvial fan settings.

The lower half of the Ringold Formation contains five separate stratigraphic intervals dominated by fluvial gravels. These gravels, designated units, A, B, C, D, and E (Figure 3-13), are separated by intervals containing deposits typical of the overbank and lacustrine facies associations. The lowermost of the fine-grained sequences, overlying unit A, is designated the lower mud sequence. The uppermost gravel unit, unit E, grades upwards into interbedded fluvial sand and overbank deposits. These sands and overbank deposits are overlain by lacustrine-dominated strata.

Fluvial gravel units A and E correspond to the lower basal and middle Ringold units respectively as defined by DOE (1988b). Gravel units B, C, and D do not correlate to any previously defined units (Lindsey 1991a). The lower mud sequence corresponds to the upper basal and lower units as defined by DOE (1988b). The upper basal and lower units are not differentiated. The sequence of fluvial sands, overbank deposits, and lacustrine sediments overlying unit E corresponds to the upper unit as seen along the White Bluffs in the eastern Pasco Basin. This essentially is the same usage as originally proposed by Newcomb (1958) and Myers et al. (1979).

3.4.2.4 Plio-Pleistocene Unit. Unconformably overlying the Ringold Formation in the western Cold Creek syncline in the vicinity of 200 West Area (Figures 3-11, 3-12, and 3-13) is the laterally discontinuous Plio-Pleistocene unit (DOE 1988b). The unit is up to 25 m (82 ft) thick and divided into two facies: (1) sidestream alluvium and (2) calcic paleosol (Stage III and Stage IV) (Bjornstad 1984; DOE 1988b). The calcic paleosol facies consists of massive calcium carbonate-cemented silt, sand and gravel (caliche) to interbedded caliche-rich and caliche-poor silts and sands. The basaltic detritus facies consists of weathered and unweathered basaltic gravels deposited as locally derived slope wash, colluvium, and sidestream alluvium. Where the unit occurs, it unconformably overlies the Ringold Formation. The Plio-Pleistocene unit appears to be correlative to other sidestream alluvial and pedogenic deposits found near the base of the ridges bounding the Pasco Basin on the north, west, and south. These sidestream alluvial and pedogenic deposits are inferred to have a late Pliocene to early Pleistocene age on the basis of stratigraphic position and magnetic polarity of interfingering loess units.

3.4.2.5 Pre-Missoula Gravels. Quartzose to gneissic clast-supported pebble to cobble gravel with a quartzo-feldspathic sand matrix underlies the Hanford formation in the east-central Cold Creek syncline and at the east end of Gable Mountain anticline east and south of the 200 East Area (Figures 3-11, 3-12, and 3-13). These gravels, called the pre-Missoula gravels (PSPL 1982), are up to 25 m (82 ft) thick, contain less basalt than underlying Ringold gravels and overlying Hanford deposits, have a distinctive white or bleached color, and sharply truncate underlying strata. The nature of the contact between the pre-Missoula gravels and the overlying Hanford formation is not clear. In addition, it is unclear whether the pre-Missoula gravels overlie or interfinger with the early "Palouse" soil and Plio-Pleistocene unit. Magnetic polarity data indicates the unit is no younger than early Pleistocene in age (>1 Ma) (Bjornstad et al. 1987).

3.4.2.6 Early "Palouse" Soil. The early "Palouse" soil consists of up to 20 m (66 ft) of massive, brown yellow, and compact, loess-like silt and minor fine-grained sand (Tallman et al. 1979, 1981; DOE 1988b). These deposits overlie the Plio-Pleistocene unit in the western Cold Creek syncline around the 200 West Area (Figures 3-11, 3-12, and 3-13). The unit is differentiated from overlying graded rhythmites (Hanford formation) by greater calcium carbonate content, massive structure in core, and high natural gamma response in geophysical logs (DOE 1988b). The upper contact of the unit is poorly defined, and it may grade up-section into the lower part of the Hanford formation. Based on a predominantly reversed polarity the unit is inferred to be early Pleistocene in age.

3.4.2.7 Hanford Formation. The Hanford formation consists of pebble to boulder gravel, fine- to coarse-grained sand, and silt. These deposits are divided into three facies: (1) gravel-dominated, (2) sand-dominated, and (3) slackwater or normally graded rhythmite. The slackwater deposits also are referred to as the "Touchet Beds," while the gravelly facies are generally referred to as the Pasco Gravels. The Hanford formation is thickest in the Cold Creek bar in the vicinity of 200 West and 200 East Areas where it is up to 65 m (213 ft) thick (Figures 3-11, 3-12, and 3-13). The Hanford formation was deposited by cataclysmic flood waters that drained out of glacial lake Missoula (Fecht et al. 1987; DOE 1988b; and Baker et al. 1991). Hanford deposits are absent on ridges above approximately 385 m (1,263 ft) above msl. The following sections describe the three Hanford formation facies.

3.4.2.7.1 Gravel-Dominated Facies. The gravel-dominated facies is dominated by coarse-grained sand and granule to boulder gravel. These deposits display massive bedding, plane to low-angle bedding, and large-scale planar cross-bedding in outcrop, while the gravels generally are matrix-poor and display an open-framework texture. Lenticular sand and silt beds are intercalated throughout the facies. Gravel clasts in the facies generally are dominated by basalt (50 to 80%). Other clast types include Ringold and Plio-Pleistocene rip-ups, granite, quartzite, and gneiss. The relative proportion of gniessic and granitic clasts in Hanford gravels versus Ringold gravels generally is higher (up to 20% as compared to less than 5%). Sands in this facies usually are very basaltic (up to 90%), especially in the granule size range. Locally Ringold and Plio-Pleistocene rip-up clasts dominate the facies comprising up to 75% of the deposit. The gravel facies dominates the Hanford formation in the 100 Areas north of Gable Mountain, the northern part of 200 East Area, and the eastern part of the Hanford Site including the 300 Area. The gravel-dominated facies was deposited by high-energy flood waters in or immediately adjacent to the main cataclysmic flood channelways.

3.4.2.7.2 Sand-Dominated Facies. The sand-dominated facies consists of fine-grained to coarse grained sand and granular gravel displaying plane lamination and bedding and less commonly plane cross-bedding in outcrop. These sands may contain small pebbles and rip-up clasts in addition to pebble-gravel interbeds and silty interbeds less than 1 m (3.3 ft) thick. The silt content of these sands is variable, but where it is low, an open framework texture is common. These sands are typically very basaltic, commonly being referred to as black or gray or salt and pepper sands. This facies is most common in the central Cold Creek syncline, in the central to southern parts of the 200 East and 200 West Areas, and in the vicinity of the Washington Public Power Supply System (WPPSS) facilities. The laminated sand facies was deposited adjacent to main flood channelways as water in the channelways spilled out of them, losing their competence. The facies varied between gravel-dominated facies and silt-dominated facies.

3.4.2.7.3 Silt-Dominated Facies. The slackwater facies consists of thinly bedded, plane laminated and ripple cross-laminated silt and fine- to coarse-grained sand that commonly display normally graded rhythmites a few centimeters to several tens of centimeters thick in outcrop (Myers et al. 1979, DOE 1988b). This facies is found throughout the central, southern, and western Cold Creek syncline within and south of 200 East and West Areas. These sediments were deposited under slackwater conditions and in backflooded areas (DOE 1988b).

3.4.2.8 Holocene Surficial Deposits. Holocene surficial deposits consist of silt, sand, and gravel that form a thin (<10 m, 33 ft) veneer across much of the Hanford Site. These sediments were deposited by a mix of eolian and alluvial processes.

3.4.3 200 East Area and B Plant Aggregate Area Geology

The following sections describe the occurrence and variation of suprabasalt sediments in the 200 East Area. The sections discuss notable stratigraphic characteristics, sediment thickness variations, dip trends, and other features such as areas where sediments are known or suspected to be absent. Also, stratigraphic variations pertinent to the B Plant Aggregate Area are identified where applicable, and are presented in the overall context of stratigraphic trends throughout the 200 East Area. The following sections are based on Lindsey et al. (1992).

Geologic cross-sections depicting the distribution of basalt and sedimentary units within and near the B Plant Aggregate Area are presented on Figures 3-14 through 3-18. Figure 3-14 illustrates the cross-sections locations. A legend for symbols used on the cross-sections is provided on Figure 3-15. The cross-sections are based on geologic information from wells shown on the figures, as interpreted in Lindsey et al. (1992). To develop these stratigraphic interpretations, logs for all the wells in the B Plant Aggregate Area were reviewed and a selection was made of the most relevant to the B Plant AAMS. The cross sections depict subsurface geology in the B Plant Aggregate Area. For each cross-section, locations of B Plant Aggregate Area waste management units are identified for reference. Figures 3-19 through 3-31 present structure maps of the top of the sedimentary units, and isopach maps illustrating the thickness of each unit in the 200 East Area and B Plant Aggregate Area. The structure and isopach maps are included from Lindsey et al. (1992). Figures 2-1 through 2-13 and Plate 1 identify the location of the B Plant Aggregate Area buildings and waste management units.

3.4.3.1 Elephant Mountain Basalt. The uppermost basalt unit beneath most of the 200 East Aggregate Area is the Elephant Mountain Member of the Saddle Mountains Basalt. At one location north of the 200 East Area, the Elephant Mountain Member is absent and the uppermost basalt encountered is the Pomona Member (Figure 3-12). Where the Elephant Mountain Member is absent the Rattlesnake Ridge Interbed, the sedimentary unit that commonly separates the Elephant Mountain and Pomona Members, is encountered above the first basalt unit (Figure 3-16).

3.4.3.2 Ellensburg Formation. The Rattlesnake Ridge Interbed of the Ellensburg Formation is found beneath the entire 200 East Area (Reidel and Fecht 1981). Mapping on Gable Mountain indicates it is absent at many localities on this structural high (Fecht 1978). Three units comprise the Rattlesnake Ridge interbed; (1) a lower clay or tuffaceous sandstone, (2) a middle, micaceous-arkosic and/or tuffaceous sandstone, and (3) an upper, tuffaceous siltstone or sandstone. In the 200 Area East, the unit thickens from 6 m (20 ft) in the north to approximately 26 m (80 ft) in the south (Lindsey 1992). The upper contact of the interbed with the overlying Elephant Mountain Member generally is baked from contact with the Elephant Mountain Basalt (Fecht 1978).

3.4.3.3 Ringold Formation. Within the 200 East Area, the Ringold Formation includes the fluvial gravels of unit A, the paleosol and lacustrine muds of the lower mud sequence, the fluvial gravels of unit E, and the sand and minor muds of the upper unit (Figure 3-13). Ringold units B, C, and D are not found in the immediate vicinity of the 200 East Area. The other Ringold strata are found throughout the southern two-thirds of the 200 East Area.

The lowest Ringold unit in the 200 East Area, the fluvial gravels of unit A, thicken and dip to the south and southwest towards the axis of the Cold Creek syncline. Unit A generally pinches out in the central part of the area against structural highs in the underlying basalt. Thin, lenticular occurrences of unit A are found locally in the area between the northeast 200 East Area and Gable Mountain. Most of the Ringold gravels encountered in the central part of the 200 East Area probably belong to unit A (Lindsey et al. 1992). The top of the unit is a relatively flat surface that dips to the south into the Cold Creek syncline. Intercalated lenticular sand and silt of the fluvial sand overbank facies associations are found locally in the middle part of the unit in the southeastern part of the area. In the B Plant Aggregate Area, the Ringold unit A is present throughout the area except in the northern portion north of the 218-E-5 Burial Ground (Figures 3-19 and 3-20).

The overbank and lacustrine deposits of the lower mud sequence thicken and dip to the south and southwest in a manner similar to the Ringold unit A gravels. However, unlike unit A, the line along which the lower mud sequences pinches out is very irregular. In the area between the 200 East Area and Gable Mountain the lower mud sequence can be found directly overlying the Elephant Mountain basalt at a number of locations where unit A is absent. Within the central part of the 200 East Area the lower mud sequence is largely absent. The nature of the pinchout of the lower mud sequence varies from location to location. At some locations it pinches out against uplifted basalt while at other locations the sequence is truncated by overlying deposits (either Ringold gravel unit E or Hanford gravels). In the area between Gable Mountain and the 200 East Area and in the vicinity of the 216-B-3 Pond complex, the lower mud sequence forms the uppermost part of the Ringold Formation and is overlain by the Hanford formation. Throughout the rest of the 200 East Area the lower mud sequence is overlain by the gravels of Ringold unit E. In regard to the B Plant Aggregate Area, the lower mud sequence is thickest in the 200-BP-2 Operable Unit where the sequence reaches a thickness of approximately 18.6 m (61 ft). The lower mud sequence is absent just north of the southern boundary of the 200-BP-9 Operable Unit (Figures 3-21 and 3-22).

Ringold unit E thickens to the south and southwest in the 200 East Area. Like the lower mud sequence, the line along which unit E pinches out is very irregular. In the 200 East Area, unit E is largely restricted to the southwest corner of the area and the GTF. It is absent in the B Pond area, the central and northern part of the area, and from the area between 200 East and Gable Mountain. Based on the stratigraphic relationships shown in Figure 3-13, most of the Ringold gravels encountered beneath the central part of the 200 East Area are part of gravel unit A and not gravel unit E. Ringold unit E dominantly consists of fluvial gravels. Strata typical of the fluvial sand and overbank facies associations may be encountered locally. However, predicting where intercalated lithologies will occur is very difficult. In the B Plant Aggregate Area, the Ringold unit E is not present north of the 200-SS-1 Operable Unit. The Ringold unit E is found only in the southern part of the B

Plant Aggregate Area and is thickest (37 m, 121 ft) near the 200-BP-2 Operable Unit (Figure 3-23).

3.4.3.4 Plio-Pleistocene Unit and Early "Palouse" Soil. The Plio-Pleistocene unit and early "Palouse" soil are not found within or near the 200 East Area or the B Plant Aggregate Area. They are encountered only near the eastern boundary of the 200 West Area approximately 5 km (3 mi) from the 200 East Area.

3.4.3.5 Hanford Formation. As discussed in the regional geology section, the cataclysmic flood deposits of the Hanford formation are divided into three facies: (1) gravel-dominated, (2) sand-dominated, and (3) the silt-dominated facies. Typical lithologic successions consist of fining upwards packages, major fine-grained intervals, and laterally persistent coarse-grained sequences. Mineralogic and geochemical data were not used in differentiating units because of the lack of a comprehensive mineralogic and geochemical data set. Studying the distribution of these facies types and identifying similarities in lithologic succession from borehole to borehole across the 200 East Area indicates the Hanford formation can be divided into three stratigraphic sequences. These sequences are designated: (1) lower gravel, (2) sand, and (3) upper gravel. However, because of the variability of Hanford deposits, contacts between the sequences can be difficult to identify.

The sequences are composed mostly of the gravel-dominated and sand-dominated facies. The silt-dominated facies are relatively rare except in the southern part of the 200 East Area. Two of the sequences are dominated by deposits typical of the gravel-dominated facies and they are designated the upper and lower gravel sequences. The third sequence consists of deposits of the sand-dominated facies with lesser intercalated occurrences from both the gravel-dominated and silt-dominated facies. This sequence, designated the sandy sequence, generally is situated between the upper and lower gravel sequences.

The lower gravel sequence is dominated by deposits typical of the gravel-dominated facies. Local intercalated intervals of the sand-dominated facies are also found. The lower gravel sequence ranges form 0 to 44 m (0 to 135 ft) thick and is found throughout most of the 200 East Area. The sequence probably is present in these areas, but because of the absence of the fine sequence that separates the lower from the upper coarse sequences it is impossible to determine the true extent of the lower coarse sequence. The contact between the lower coarse sequence and the overlying sandy sequence is arbitrarily placed at the top of the first thick (>6 m, >20 ft) gravel interval encountered below the sand-dominated strata of the sandy sequence. In the B Plant Aggregate Area the lower gravel sequence is thickest near the western border of the 200-BP-11 Operable Unit, the lower gravel sequence is absent throughout most of the 200-BP-5 Operable Unit as well as the northeast corner of the 200-SS-1 Operable Unit (Figures 3-26 and 3-27).

The sandy sequence consists of a heterogenous mix of sands typical of the sand-dominated facies. Deposits of the silt-dominated facies are present, but less abundant. The sandy sequence ranges from 0 to 92 m (0 to 280 ft) thick. This sequence is dominated by the sand-dominated facies in the north, and the slackwater facies towards the south. Gravels, occurring both singly and as interbeds are common in the sandy sequence, especially towards the north. Thin intervals typical of the gravel facies also are encountered. The sandy sequence probably contains the greatest concentration of clastic dikes and it is laterally equivalent with lower fine sequence in the 200 West Area (Lindsey et al. 1991). Where the sandy sequence pinches out it commonly interfingers with gravels of the overlying and underlying gravel sequences. Where this occurs the contact separating the sandy sequence from the other intervals is arbitrary. The sandy sequence is differentiated from the gravelly strata of the upper and lower gravel sequences on the basis of sand content. The base of the sandy sequence is placed at the top of the highest gravelly interval and underlies sand-dominated strata. The top of the sequence is placed at the top of the highest thick, sand-dominated interval. In the B Plant Aggregate Area, the thickness of the sequence ranges from 0 m (0 ft) near the B and C Lobes of the 216-B-3 Ponds to 61 m (200 ft) near the 200-BP-10 Operable Unit (Figures 3-28 and 3-29).

The third Hanford formation stratigraphic sequence consists of gravel-dominated strata referred to as the upper gravel sequence. This sequence is dominated by deposits typical of the gravel-dominated facies. Lesser occurrences of the sand-dominated facies are encountered locally. The sequence thins from as much as 60 m (182 ft) in the north to zero near the southern border of the 200 East Area. In addition, at one location, northwest of the 200 East Area, the sequence thins more than surrounding localities and at another location, in the central part of the 200 East Area, the unit is completely absent. Where the upper gravel sequence is thickest, in the north, it is found to form an elongated northwest to southeast oriented body. The upper coarse and lower coarse sequences are not differentiated in this area where the intervening sandy sequence is absent. In the B Plant Aggregate Area the thickness of the upper gravel sequence is absent near the 216-B-3C Lobe of B Pond, and absent in all of the 200-BP-2 Operable Unit. The maximum thickness of the upper gravel in the B Plant operable unit is 33.2 m (109 ft) near Gable Mountain Pond (Figures 3-30 and 3-31).

3.4.3.6 Holocene Surficial Deposits. Holocene-age surficial deposits in the 200 East Area are dominated by very fine- to medium-grained to occasionally silty eolian sands. These deposits have been removed from much of the area by construction activities. Where the eolian sands are found they tend to consist of thin (<3 m, 10 ft) sheets that cover the ground. Dunes are not generally well developed within the 200 East Area. The Holocene surficial deposits are not differentiated on cross-sections and maps because they are relatively thin and because of the lack of definition on so many of the borehole geologic logs available for the 200 East Area and the B Plant Aggregate Area.

3.5 HYDROGEOLOGY

The following sections present discussions of regional hydrogeology (Section 3.5.1), Hanford Site hydrogeology (3.5.2), and B Plant Aggregate Area hydrogeology (Section 3.5.3). Sections 3.5.2 and 3.5.3 also discuss Hanford Site and B Plant Aggregate Area vadose zone characteristics.

3.5.1 Regional Hydrogeology

The hydrogeology of the Pasco Basin is characterized by a multiaquifer system that consists of four hydrogeological units that correspond to the upper three formations of the Columbia River Basalt Group (Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt) and the suprabasalt sediments. The basalt aquifers consist of the tholeiitic flood basalts of the Columbia River Basalt Group and relatively minor amounts of intercalated fluvial and volcaniclastic sediments of the Ellensburg Formation. Confined zones in the basalt aquifers are present in the sedimentary interbeds and/or interflow zones that occur between dense basalt flows. The main water-bearing portions of the interflow zones are networks of interconnecting vesicles and fractures of the flow tops and flow bottoms (DOE 1988b). The suprabasalt sediment or uppermost aquifer system consists of fluvial, lacustrine, and glaciofluvial sediments. This aquifer is regionally unconfined and is contained largely within the Ringold Formation and Hanford formation. The position of the water table in the southwest Pasco Basin is generally within the Ringold fluvial gravels of unit E. In the northern and eastern Pasco Basin the water table is generally within the Hanford formation. Table 3-1 presents hydraulic parameters for various water-bearing geologic units at the Hanford Site.

Local recharge to the shallow basalt aquifers results from infiltration of precipitation and runoff along the margins of the Pasco Basin, and in areas of artificial recharge where a downward gradient from the unconfined aquifer systems to the uppermost confined basalt aquifer may occur. Regional recharge of the deep basalt aquifers is inferred to result from interbasin groundwater movement originating northeast and northwest of the Pasco Basin in areas where the Wanapum and Grande Ronde Basalts crop out extensively (DOE 1988b). Groundwater discharge from shallow basalt aquifers is probably to the overlying aquifers and to the Columbia River. The discharge area(s) for the deeper groundwater system is uncertain, but flow is inferred to be generally southeastward with discharge thought to be south of the Hanford Site (DOE 1988b).

Erosional "windows" through dense basalt flow interiors allow direct interconnection between the uppermost aquifer systems and underlying confined basalt aquifers. Graham et al. (1984) reported that some contamination was present in the uppermost confined aquifer (Rattlesnake Ridge interbed) south and east of Gable Mountain Pond. Graham et al. (1984) evaluated the hydrologic relationships between the Rattlesnake Ridge Interbed aquifer and the unconfined aquifer in this area and delineated a potential area of intercommunication beneath the northeast portion of the 200 East Area.

The base of the uppermost aquifer system is defined as the top of the uppermost basalt flow. However, fine-grained overbank and lacustrine deposits in the Ringold Formation locally form confining layers for Ringold fluvial gravels underlying unit E. The uppermost aquifer system is bounded laterally by anticlinal basalt ridges and is approximately 152 m (500 ft) thick near the center of the Pasco Basin.

Sources of natural recharge to the uppermost aquifer system are rainfall and runoff from the higher bordering elevations, water infiltrating from small ephemeral streams, and river water along influent reaches of the Yakima and Columbia Rivers. The movement of precipitation through the unsaturated (vadose) zone has been studied at several locations on the Hanford Site (Gee 1987; Routson and Johnson 1990; Rockhold et al. 1990). Conclusions from these studies vary. Gee (1987) and Routson and Johnson (1990) conclude that no downward percolation of precipitation occurs on the 200 Areas Plateau where the sediments are layered and vary in texture, and that all moisture penetrating the soil is removed by evapotranspiration. Rockhold et al. (1990) suggest that downward water movement below the root zone is common in the 300 Area, where soils are coarse-textured and precipitation was above normal.

3.5.2 Hanford Site Hydrogeology

This section describes the hydrogeology of the Hanford Site with specific reference to the 200 Areas.

3.5.2.1 Hydrostratigraphy. The hydrostratigraphic units of concern in the 200 Areas are (1) the Rattlesnake Ridge interbed (confined water-bearing zone), (2) the Elephant Mountain Basalt member (confining horizon), (3) the Ringold Formation (unconfined and confined water-bearing zones and lower part of the vadose zone), (4) the Plio-Pleistocene unit and early "Palouse" soil (primary vadose zone perching horizons and/or perched groundwater zones) and (5) the Hanford formation (vadose zone) (Figure 3-32). The Plio-Pleistocene unit and early "Palouse" soil are only encountered in the 200 West Area. Strata below the Rattlesnake Ridge interbed are not discussed because the more significant water-bearing intervals, relating to environmental issues, are primarily closer to ground surface. The hydrogeologic designations for the 200 Areas were determined by examination of borehole logs and integration of these data with stratigraphic correlations from existing reports.

3.5.2.1.1 Vadose Zone. The vadose zone beneath the 200 Areas ranges from approximately 55 m (180 ft) beneath the former U Pond to approximately 97 m (318 ft) in the southern portion of the 200 East Area (Last et al. 1989). Sediments in the vadose zone consist of the (1) fluvial gravel of Ringold unit E, (2) the upper unit of the Ringold Formation, (3) Plio-Pleistocene unit, (4) early "Palouse" soil, and (5) Hanford formation. Only the Hanford formation is continuous throughout the vadose zone in the 200 Areas. The upper unit of the Ringold Formation, the Plio-Pleistocene unit, and the early "Palouse" soil only occur in the 200 West Area. In the 200 East Area the Plio-Pleistocene and early "Palouse" soil are absent. The unconfined aquifer water table (discussed in Section 3.5.2.1.3) lies within the Ringold unit E.

The transport of water through the vadose zone depends in complex ways on several factors, including most significantly the moisture content of the soils and their hydraulic properties. Darcy's law, although originally conceived for saturated flow only, was extended by Richards to unsaturated flow, with the provisions that the soil hydraulic conductivity becomes a function of the water content of the soil and the driving force is predominantly differences in moisture level. The moisture flux, q, in cm/s in one direction is then described by a modified form of Darcy's law commonly referred to as Richards' Equation (Hillel 1971) as follows:

$$q = K(\theta) \times \partial\varphi/\partial\theta \times \partial\theta/\partial x \text{ (Richards' Equation)}$$

where

- $K(\theta)$ is the water-content-dependent unsaturated hydraulic conductivity in cm/s

- $\partial\varphi/\partial\theta$ is the slope of the soil-moisture retention curve $\varphi(\theta)$ at a particular volumetric moisture content θ (a soil-moisture retention curve plots volumetric moisture content observed in the field or laboratory against suction values for a particular soil, see Figure 3-33 from Gee and Heller (1985) for an example)

- $\partial\theta/\partial x$ is the water content gradient in the x direction.

More complicated forms of this equation are also available to account for the effects of more than one dimensional flow and the effects of other driving forces such as gravity.

The usefulness of Richards' Equation is that knowing the moisture content distribution in soil, having measured or estimated values for the unsaturated hydraulic conductivity corresponding to these moisture contents, and having developed a moisture retention curve for this soil, one can calculate a steady state moisture flux. With appropriate algebraic manipulation or numerical methods, one could also calculate the moisture flux under transient conditions.

In practice, applying Richards' Equation is quite difficult because the various parameters involved are difficult to measure and because soil properties vary depending on whether the soil is wetting or drying. As a result, soil heterogeneities affect unsaturated flow even more than saturated flow. Several investigators at the Hanford Site have measured the vadose zone moisture flux directly using lysimeters (e.g., Rockhold et al. 1990; Routson and Johnson 1990). These direct measurements are discussed in Section 3.5.2.2 under the heading of natural groundwater recharge.

An alternative to direct measurement of unsaturated hydraulic conductivity is to use theoretical methods that predict the conductivity from measured soil moisture retention data (Van Genuchten 1991).

Thirty-five soil samples from the 200 West Area have had moisture retention data measured. These samples were collected from Wells 299-W18-21, 299-W15-16, 299-W15-2, 299-W10-13, 299-W7-9, and 299-W7-2. Eleven of these samples were reported by Bjornstad (1990). The remaining 24 were analyzed as part of an ongoing performance assessment of the low-level burial grounds (Connelly et al. 1992). For each of these samples saturated hydraulic conductivity was measured in the laboratory. Van Genuchten's computer program RETC was then used to develop wetting and drying curves for the Hanford, early "Palouse," Plio-Pleistocene, upper Ringold, and Ringold Gravel lithologic units. An example of the wetting and drying curves, and corresponding grain size distributions, is provided on Figure 3-33.

The unsaturated hydraulic conductivities may vary by orders of magnitude with varying moisture contents and among differing lithologies with significantly different soil textures and hydraulic conductivities. Therefore, choosing a moisture retention curve should be made according to the particle size analyses of the samples and the relative density of the material.

Once the relationship between unsaturated hydraulic conductivity and moisture content is known for a particular lithologic unit, travel time can also be estimated for a steady-state flux passing through each layer by assuming a unit hydraulic gradient. Under the unit gradient condition, only the force of gravity is acting on water and all other forces are considered negligible. These assumptions may be met for flows due to natural recharge since moisture differences become smoothed out after sufficient time. Travel time for each lithologic unit of a set thickness and calculated for any given recharge rate and the total travel time is equivalent to the sum of the travel times for each individual lithologic unit. To calculate the travel time for any particular waste management unit the detailed layering of the lithologic units should be considered. For waste management units with artificial recharge (e.g., cribs and trenches) more complicated analyses would be required to account for the effects of saturation.

Several other investigators have measured vadose zone soil hydraulic conductivities and moisture retention characteristics at the Hanford Site both in situ (i.e., in lysimeters) and in specially prepared laboratory test columns. Table 3-2 summarizes data identified for this study by stratigraphic unit. Rockhold et al. (1988) presents a number of moisture retention characteristic curves and plots of hydraulic conductivity versus moisture content for various Hanford soils. For the Hanford formation, vadose zone hydraulic conductivity values at saturation range from 10^{-4} to 10^{-2} cm/s. These saturated hydraulic conductivity values were measured at volumetric water contents of 40 to 50%. Hydraulic conductivity values corresponding to volumetric water contents, ranging from 2 to 10%, ranged from 2×10^{-11} to 7×10^{-7} cm/s.

An example of the potential use of this vadose zone hydraulic parameter information is presented by Smoot et al. (1989) in which precipitation infiltration and subsequent contaminant plume movement near a prototype single-shell tank was evaluated using a numerical computer code. Smoot et al. (1989) used the UNSAT-H one-dimensional finite-difference unsaturated zone water flow computer code to predict the precipitation infiltration for several different soil horizon combinations and characteristics. The researchers used statistically generated precipitation values that were based on actual daily precipitation values recorded at the Hanford Site between 1947 and 1989 to simulate precipitation infiltration from January 1947 to December 2020. The same authors also used the PORFLO-3 computer code to simulate ^{106}Ru and ^{137}Cs movement through the unsaturated zone.

Smoot et al. (1989) concluded that 68 to 86% of the annual precipitation infiltrated into a gravel-capped soil column while less than 1% of the annual precipitation infiltrated into a silt loam-capped soil column. For the gravel-capped soil column, the simulations showed the ^{106}Ru plume approaching the water table after 10 years of simulated precipitation infiltration. The simulated ^{137}Cs plume migrated a substantially shorter distance due to greater adsorption on soil particles. In both cases, the simulated plume migration scenarios are considered to be conservative due to the relatively soil absorption coefficients used.

Graham et al. (1981) estimated that historical artificial recharge from liquid waste disposal in the 200 (Separations) Areas exceeded all natural recharge by a factor of ten. In the absence of ongoing artificial recharge, i.e., liquid waste disposal to the soil column, natural recharge could potentially be a driving force for mobilizing contaminants in the subsurface. Natural sources of recharge to the vadose zone and the underlying water table aquifer are discussed in Section 3.5.2.2. Additional discussion of the potential for natural and artificial recharge to mobilize subsurface contaminants is presented in Section 4.2.

Another facet of moisture migration in the vadose zone is moisture retention above the water table. Largely because of capillary forces, some portion of the moisture percolating down from the ground surface to the unconfined aquifer will be held against gravity in soil pore space. Finer-grained soils retain more water (against the force of gravity) on a volumetric basis than coarse-grained soils (Hillel 1971). Because unsaturated hydraulic conductivity increases with increasing moisture content, finer-grained soils may be more permeable than coarse-grained soils at the same water content. Also, because the moisture retention curve for coarse-grained soils is generally quite steep (Smoot et al. 1989), the permeability contrast between fine-grained and coarse-grained soils at the same water content can be substantial. The occurrence of interbedded fine-grained and coarse-grained soils may result in the formation of "capillary barriers" and can in turn lead to the formation of perched water zones. General conditions leading to the formation of perched water zones at the Hanford Site are discussed in Section 3.5.2.1.2. The potential for perched water zones in the B Plant Aggregate Area is discussed in Section 3.5.3.1.2.

3.5.2.1.2 Perched Water Zones. Moisture moving downward through the vadose zone may accumulate on top of highly cemented horizons and may accumulate above the contact between a fine-grained horizon and an underlying coarse-grained horizon as a result of the "capillary barrier" effect. If sufficient moisture accumulates, the soil pore space in these perching zones may become saturated. In this case, the capillary pressure within the horizon may locally exceed atmospheric pressure, i.e., a water table condition may develop. Additional input of downward percolating moisture to this horizon may lead to a hydraulic head buildup above the top of the horizon. Consequently, a monitoring well screened within or above this horizon would be observed to contain free water.

The lateral extent and composition of the Plio-Pleistocene and early "Palouse" soil units may provide conditions amenable to the formation of perched water zones in the vadose zone above the unconfined aquifer. The calcrete facies of the Plio-Pleistocene unit, consisting of calcium-carbonate-cemented silt, sand, and gravel, is a potential perching horizon due to its likely low hydraulic conductivity. However, the Plio-Pleistocene unit is typically fractured and may have erosional scours in some areas, potentially allowing deeper infiltration of groundwater, a factor which may limit the lateral extent of accumulated perched groundwater. The early "Palouse" soil horizon, consisting of compact, loess-like silt and minor fine-grained sand, is also a likely candidate for accumulating moisture percolating downward through the sand and gravel-dominated Hanford formation. As discussed earlier, the Plio-Pleistocene unit and the early "Palouse" soil do not occur in the 200 East Area. Therefore, the potential for perched water occurring in the B Plant Aggregate Area is low.

3.5.2.1.3 Unconfined Aquifer. The uppermost aquifer system in the 200 Areas occurs primarily within the sediments of the Ringold Formation and Hanford formation. In the 200 West Area the upper aquifer is contained within the Ringold Formation and displays unconfined to locally confined or semiconfined conditions. In the 200 East Area the upper aquifer occurs in the Ringold Formation and Hanford formation. The depth to groundwater in the upper aquifer underlying the 200 Areas ranges from approximately 60 m (197 ft) beneath the former 216-U-10 Pond in the 200 West Area to approximately 105 m (340 ft) west of the 200 East Area to approximately 103 m (313 ft) near the 202-A Building in the 200 East Area. The saturated thickness of the unconfined aquifer ranges from approximately 67 to 112 m (220 to 368 ft) in the 200 West Area and approximately 61 m (200 ft) in the southern 200 East Area to nearly absent in the northeastern 200 East Area where the aquifer thins out and terminates against the basalt located above the water table in that area.

The upper part of the uppermost aquifer in the 200 East Area consists of generally unconfined groundwater within the Ringold unit E. In the northern part of the B Plant Aggregate Area the Ringold Formation has been eroded and the groundwater is found within the Hanford formation. The lower part of the uppermost aquifer consists of confined to semi-confined groundwater within the gravelly sediments of Ringold unit A. The Ringold unit A is generally confined by fine-grained sediments of the lower mud sequence.

Because of its importance with respect to contaminant transport, the unconfined aquifer is generally the most characterized hydrologic unit beneath the Hanford Site. A number of observation wells have been installed and monitored in the unconfined aquifer. Additionally, in situ aquifer tests have been conducted in a number of the unconfined aquifer monitoring wells. Results of these in situ tests vary greatly depending on the following:

- Horizontal position/location between areas across the Hanford Site and even smaller areas (such as across portions of the 200 Areas)
- Depth, even within a single hydrostratigraphic unit
- Analytical methods for estimating hydraulic conductivity.

Details regarding this aquifer system will be discussed in the 200 East Groundwater Aggregate Area Management Study Report (AAMSR).

3.5.2.2 Natural Groundwater Recharge. Sources of natural recharge to groundwater at the Hanford Site include precipitation infiltration, runoff from higher bordering elevations and subsequent infiltration within the Hanford Site boundaries, water infiltrating from small ephemeral streams, and river water infiltrating along influent reaches of the Yakima and Columbia Rivers (Graham et al. 1981). The principal source of natural recharge is believed to be precipitation and runoff infiltration along the periphery of the Pasco Basin. Small streams such as Cold Creek and Dry Creek also lose water to the ground as they spread out on the valley plain. Considerable debate exists as to whether any recharge to groundwater occurs from precipitation falling on broad areas of the 200 Areas Plateau.

Natural precipitation infiltration at or near waste management units or unplanned releases may provide a driving force for the mobilization of contaminants previously introduced to surface or subsurface soils. For this reason, determination of precipitation recharge rates at the Hanford Site has been the focus of many previous investigations. Previous field programs have been designed to assess precipitation, infiltration, water storage changes, and evaporation to evaluate the natural water balance during the recharge process. Precipitation recharge values ranging from 0 to 10 cm/yr have been estimated from various studies.

The primary factors affecting precipitation recharge appear to be surface soil type, vegetation type, topography, and year-to-year variations in seasonal precipitation. A modeling analysis (Smoot et al. 1989) indicated that 68 to 86% of the precipitation falling on a gravel-covered site might infiltrate to a depth greater than 2 m (6 ft). As discussed below, various field studies suggest that less than 25% of the precipitation falling on typical Hanford Site soils actually infiltrates to any depth.

Examples of precipitation recharge studies include:

- A study by Gee and Heller (1985) described various models used to estimate natural recharge rates. Many of the models use a water retention relationship for the soil. This relates the suction required to remove (or move) water to its dryness (saturation or volumetric moisture content). Two of these have been developed by Gee and Heller (1985) for soils in lysimeters on the Hanford Site. As an example of available data, the particle size distribution and the water retention curves of these two soils are shown in Figure 3-34. Additional data and information about possible models for unsaturated flow may be found in Brownell et al. (1975), and Rockhold et al. (1990).

- Moisture contents have been obtained from a number of core-barrel samples in the 200 Areas (East and West) and varied from 1 to 18%, with most in the range of 2 to 6% (Last et al. 1989). The data appear to indicate zones of increased moisture content that could be interpreted as signs of moisture transport.

- A lysimeter study reported by Routson and Johnson (1990) was conducted at a location 1.6 km south of the 200 East Area. During much of the lysimeters' 13-year study period between 1972 and 1985, the surface of the lysimeters were maintained unvegetated with herbicides. No information regarding the soil types in the lysimeters was found. To a precision of +/- 0.2 cm, no downward moisture movement was observed in the instruments during periodic neutron-moisture measurements or as a conclusion of a final soil sample collection and moisture content analysis episode.

- An assessment of precipitation recharge involving the redistribution of ^{137}Cs in vadose zone soil also reported by Routson and Johnson (1990). In this study, split-spoon soil samples were collected beneath a solid waste burial trench in the T Plant Aggregate Area. The trench, located just south and west of the 218-W-3AE Burial Ground, approximately 6 km (3.7 mi) west of the 200 East Area, received soil containing ^{137}Cs from an unspecified spill. Cesium-137 was not detected below the bottom of the burial trench. However, increased ^{137}Cs activity was observed above the top of the waste fill which Routson and Johnson concluded indicated that net negative recharge (loss of soil moisture to evapotranspiration) had occurred during the 10-year burial period.

  Sparse Russian thistle was observed at the burial trench area in 1980. Rockhold et al. (1990) noted that ^{137}Cs appears to strongly sorb to Hanford Site soils indicating that the absence of the radionuclide at depth below the burial trench may not support the conclusion that no downward moisture movement occurred.

- A weighing lysimeter study reported by Rockhold et al. (1990) was conducted at a grassy plot approximately 5 km (3 mi) northwest of the 300 Area. The grass test site was located in a broad, shallow topographic depression approximately 900 m (2,953 ft) wide, several hundred meters long, trending southwest. The area is covered with annual grasses (cheatgrass and bluegrass). The upper 3.5 m (11.5 ft) of the soil profile consists of slightly silty to silty sand (sandy loam) with an estimated saturated hydraulic conductivity of 9×10^{-3} cm/s. Rockhold et al. (1990) estimated that approximately 0.8 cm (0.3 in.) of downward moisture movement occurred between July 1987 and June 1988. This represents approximately 7% of the total precipitation recorded in that area during that time period.

- A gravel-covered lysimeter study discussed by Rockhold et al. (1990) was conducted at the 200 East Area lysimeter site, approximately 1 km (1.6 mi) south of the 200 East Area. Water contents below the 4.88 m (16 ft) depth in the closed-bottom lysimeter have not changed reasonably between 1972 and 1988, implying that significant recharge has not occurred. Data are insufficient to conclude whether the presence of a plant community on the lysimeter is the reason for the lack of water increase.

The drainage (downward moisture movement) observed in these studies may represent potential recharge to deeper vadose zone soils and/or the underlying water table.

3.5.2.3 Groundwater Flow. Groundwater flow north of Gable Mountain currently trends in a northeasterly direction as a result of mounding near reactors and flow through Gable Gap. South of Gable Mountain, flow is interrupted locally by the groundwater mounds in the 200 Areas. There is also a component of groundwater flow to the north between Gable Mountain and Gable Butte from the 200 Areas. In the 200 East Area, groundwater elevations in June 1990 for the unconfined aquifer showed little variation and were generally around 133 m (405 ft) (Kasza et al. 1990).

Temporary reversal of groundwater flow entering the Columbia River may occur during transient, high-river stages. This occurrence is known as bank storage. Correlations were made between groundwater level and river-stage fluctuations along a 81 km (50 mi) reach of the Columbia River adjacent to the Hanford Site by Newcomb and Brown (1961). They concluded that a 260 km^2 (100 mi^2) area within the Hanford Site was affected by bank storage. During a 45 day rise in river stage, it was estimated that water infiltrated at an average rate of 4,500,000 m^3/day (3,700 acre-ft/day) versus 1,233,000 m^3/day (1,000 acre-ft/day) during the 165 day recession period. Since this study was conducted, dam control on the Columbia River has reduced the magnitude of bank storage on the groundwater system.

Natural groundwater inflow to the unconfined aquifer primarily occurs along the western boundary of the Hanford Site. Currently, manmade recharge occurs in several active waste management units (e.g., the 216-U-14 Ditch, 216-U-17 Crib, and the 216-Z-20 Crib) located within the U Plant Aggregate Area in the 200 West Area. Historically, much greater recharge occurred from a number of waste management units in the 200 Areas. Manmade recharge probably substantially exceeds natural precipitation recharge in these areas. The unconfined aquifer ultimately discharges to the Columbia River, either near the 100 Areas, north of the 200 Areas through Gable Gap, or between the 100 Areas and the 300 Area, east of the 200 Areas. The precise path is strongly dependent on the hydrologic conditions in the 200 East Area (Delaney et al. 1991). If recharge in the 200 East Area is large, more of the recharge from the 200 West Area is diverted north through Gable Gap toward the 100 Areas. Generally, however, the easterly route appears to be more likely for recharge from the 200 West Area.

3.5.2.4 Historical Effects of Operations. Historical effluent disposal at the Hanford Site altered previously prevailing groundwater hydraulic gradients and flow directions. Before operations at the Hanford Site began in 1944, groundwater flow was generally toward the east, and the groundwater hydraulic gradient in the 200 East Area was on the order of 0.0003 (Delaney et al. 1991). Prior to disposing liquid waste to the soil column in the 200 (Separations) Areas, groundwater elevations in the 200 East Area may have been as much as

18 m (55 ft) lower in 1944 than at present. As seen in Figure 3-40, a distinct groundwater mound is still apparent east of the 200 East Area near the 216-B-3 Pond. The 216-B-3 Pond has caused the groundwater flow direction to change to a northwest-southeast flow pattern.

3.5.3 B Plant Aggregate Area Hydrogeology

This section presents additional hydrogeologic information identified with specific application to the B Plant Aggregate Area.

3.5.3.1 Hydrostratigraphy. As shown on Figure 3-36, the hydrostratigraphic units of concern beneath the B Plant Aggregate Area are (1) the Rattlesnake Ridge interbed, (2) the Elephant Mountain Basalt member, (3) the Ringold Formation units A and E, and (4) the Hanford formation. The hydrogeologic designations for the B Plant Aggregate Area were determined by examination of borehole logs from Lindsey et al. (1992) and Chamness et al. (1992) and integration of these data with stratigraphic correlations from existing reports. For the purposes of the B Plant AAMSR, this discussion will be limited to the vadose zone and possible perching horizons with the vadose zone underlying the aggregate area. Additional information on the aquifer systems will be discussed in the 200 East Groundwater AAMSR.

3.5.3.1.1 Vadose Zone. The vadose zone beneath the B Plant Aggregate Area ranges in thickness from about 104 m (341 ft) along the southern part of the western aggregate area boundary to 37 m (123 ft) in the vicinity of the 216-B-3C Pond based on June 1990 groundwater elevation data (Kasza et al. 1990). The observed variation in vadose zone thickness is the result of variable surface topography and the variable elevation of the water table in the underlying unconfined aquifer.

During the 1985 Grout Treatment Facility (GTF) baseline and site characterization study, several groundwater monitor wells were drilled (Swanson et al. 1988). The data collected from the drilling of these wells (299-E25-25, 299-E25-26, 299-E25-27 and 299-E25-28) provided information pertaining to the vadose zone east of the B Plant Aggregate Area. Similar data were collected, to the west from groundwater monitor wells adjacent to the 216-U-12 Crib and at the southwest border of the U Plant Aggregate Area (Goodwin 1990). Because of the nearly identical stratigraphy, it is probable the B Plant Aggregate Area vadose zone is similar and it can be assumed that the collected data are correct for this study area. Analysis of the borehole samples collected from the GTF and U Plant indicate that soil moisture is normally between $<1\%$ to 27% by weight. Of 105 samples analyzed for moisture content from the U Plant Aggregate Area, 86% were between 1% and 10% by weight. At the GTF, 126 samples were collected for soil moisture and 89% were between 1% and 10% by weight. It should be noted however, that both investigations are in the vicinity of previously active cribs and/or ditches, and that there is some impact by the disposal of liquid waste on these moisture contents.

3.5.3.1.2 Perched Water Zones. Unlike the 200 West Area, the likelihood of perched water occurring in the 200 East Area is low. In the 200 West Area perched water is found predominantly in the Plio-Pleistocene and the early "Palouse" soil. Those stratigraphic units are not present in the 200 East Area. However, perched water zones are still possible because of the large quantity of liquid waste disposed, provided that the proper soil grain size and intercalated lenses exist.

Perched water has been found in the 200 East Area near the B Pond system. The main aquifer in this area is within the fluvial gravel Unit A of the Ringold Formation. In two boreholes drilled in the "C" lobe of B Pond, perched water was found above the clayey lower mud sequence of the Ringold Formation. The lower mud sequence is also found below the "A" lobe of the B Pond and beneath the main portion of the B Pond, though perched water has not been detected in these locales. Where the perched water has been found, it is moving down-dip (southeast) and into the main aquifer of the Unit A fluvial gravels.

3.5.3.2 Natural Groundwater Recharge. As discussed in Section 3.3.3, only one natural surface water body exists within the B Plant Aggregate Area near Gable Mountain. Other than in this one location, the potential for natural groundwater recharge within the B Plant Aggregate Area is limited to precipitation infiltration. No precipitation infiltration data were identified with specific reference to the B Plant Aggregate Area. However, the amount of precipitation infiltration is likely comparable to the range of values identified for various Hanford test sites, i.e., 0 to 10 cm/yr.

As suggested in Section 3.5.2.2, precipitation infiltration rates probably vary with respect to location within the B Plant Aggregate Area. Higher infiltration rates are expected in unvegetated areas or areas with shallow rooting plants. Higher infiltration rates are also expected in areas with gravelly soils exposed at the surface.

3.5.3.3 Groundwater Flow Beneath the B Plant Aggregate Area. Within the B Plant Aggregate Area, groundwater flow is generally toward the west, based on December 1990 Hanford wells groundwater elevation data (DOE/RL 1991b) (Figure 3-35). Flow is generally away from the groundwater mound located below the 216-B-3 Pond just east of the B Plant Aggregate Area. A review of groundwater maps of the unconfined aquifer (Kasza et al. 1990) indicates relatively steep decreases in groundwater elevations directly west of the mound and a very gradual elevation decrease to the west across the B Plant Aggregate Area. A detailed evaluation of the groundwater flow beneath the B Plant Aggregate Area will be discussed in the 200 East Groundwater Aggregate Area Management study.

3.5.3.4 Historical Effects of Operations. Artificial recharge from waste management facilities within the 200 East Area has caused significant changes to the water levels of the unconfined aquifer since operations began in 1943. Historically, the majority (greater than 90%) of wastewater discharged from the 200 East Area has been routed to the B or Gable Mountain Ponds (Zimmerman et al. 1986). Between 1943 and 1980 approximately 3.433 x 10^{11} L of wastewater had been discharged to these ponds. The B Pond received greater than 90% of the wastewater discharged from the 200 East Area between 1945 and 1955. In 1957 the Gable Mountain Pond began receiving wastewater. From 1956 to 1980 these ponds received over 90% of the wastewater generated from the 200 East Area. This discharging has created elevated groundwater levels, or mounding of the groundwater, in the vicinity of the B and Gable Mountain Ponds.

Between 1950 and 1955 small groundwater elevation increases occurred south of Gable Mountain in response to wastewater discharges from the B Plant. Groundwater mounding in the vicinity of the B Pond continued in response to the startup of the PUREX Plant in 1956 and new discharges to the Gable Mountain Pond. During this time the artificial recharge caused elevations to reach approximately 10 m (32 ft) above the natural groundwater elevations.

During the 1960's the groundwater mound grew at a much slower rate and reached near equilibrium conditions during the 1970's. During the 1980's three expansion ponds were created near the B Pond to receive wastewater redirected from the Gable Mountain Pond and the PUREX Plant which resumed production in 1983. This increased discharge amount has elevated groundwater levels in the vicinity of the B Pond approximately 1.5 m (5 ft) between December 1979 and December 1989. Groundwater elevations in the vicinity of the Gable Mountain Pond have decreased approximately 1 m (3 ft) during this same time.

3.6 ENVIRONMENTAL RESOURCES

The Hanford Site is characterized as a cool desert or a shrub-steppe and supports a biological community typical of this environment.

3.6.1 Flora and Fauna

The 200 Areas Plateau is represented by a number of plant, mammal, bird, reptile, amphibian, and insect species as discussed below.

3.6.1.1 Vegetation of the 200 Areas Plateau. The vegetation of the 200 Areas Plateau is characterized by native shrub steppe interspersed with large areas of disturbed ground with a dominant annual grass component. The native stands are classified as an *Artemisia tridentata/Poa sandbergii - Bromus tectorum* community (Rogers and Rickard 1977) meaning that the dominant shrub is big sagebrush (*Artemisia tridentata*) and the understory is dominated by the native Sandberg's bluegrass (*Poa sandbergii*) and the introduced annual cheatgrass (*Bromus tectorum*). Other shrubs that are typically present include gray rabbitbrush (*Chrysothamnus nauseosus*), green rabbitbrush (*C. viscidiflorus*), spiny hopsage (*Grayia spinosa*), and occasionally antelope bitterbrush (*Pursia tridentata*). Other native bunchgrasses that are typically present include bottlebrush squirreltail (*Sitanion hystrix*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread (*Stipa comata*), and prairie junegrass (*Koleria cristata*). Common and important herbaceous species include turpentine cymopteris (*Cymopteris terebinthinus*), globemallow (*Spheracea munroana*), balsamroot (*Basamorhiza careyana*), several milk vetch species (*Astragalus caricinus*, *A. sclerocarpus*, *A. succumbens*), long-leaf phlox (*Phlox longifolia*), the common yarrow (*Achillea millifolium*), pale evening-primrose (*Oenothera pallida*), thread-leaf phacelia (*Phacelia linearis*), and several daisy/fleabane species (*Erigeron poliospermus*, *E. Filifolius*, and *E. pumilus*). In all, well over 100 plant species have been documented to occur in native stands on the 200 Areas Plateau.

Disturbed communities on the 200 Areas Plateau are primarily the result of either mechanical disturbance or range fires. Mechanical disturbance, including construction activities, soil borrow areas, road clearings, and fire breaks, results in drastic changes to the plant community. This type of disturbance usually entails a complete loss of soil structure and total disruption of nutrient cycling. The principle colonizers of mechanically disturbed areas are the annual weeds Russian thistle (*Salsola kali*), Jim Hill mustard (*Sisymbrium altissimum*), and bur-ragweed (*Ambrosia acanthicarpa*). If no further disturbance occurs, the areas will eventually become dominated by cheatgrass. All of these annual weeds are occasionally found in native stands, but only at relatively low frequencies.

Range fires also have dramatic effects on the overall ecosystem, the most obvious being the complete removal of sagebrush from the community, and the rapid increase in cheatgrass coverage. Unlike the native grasses, the other important shrubs, and many of the perennial herbaceous species, sagebrush is unable to resprout from rootstocks after being burned. Therefore, there is no dominant shrub component in burned areas until sagebrush is able to become re-established from seed. Burning also opens the community to the invasion by cheatgrass, which is capable of quickly utilizing the nutrients that are released through burning. The extensive cover of cheatgrass may then prevent the re-establishment of many of the native species, including sagebrush. The species richness in formerly burned areas is usually much lower than in native stands, often consisting of only cheatgrass, Sandberg's bluegrass, Russian thistle, and Jim Hill mustard, with very few other species.

The vegetation in and around the ponds and ditches on the 200 Areas Plateau is significantly different from that of the surrounding dryland areas. Several tree species are present, especially cottonwood (*Populus trichocarpa*) and willows (*Salix* spp.). A number of wetland species area also present including several sedges (*Carex* spp.), bulrushes (*Scirpus* spp.), cattails (*Typha latifolia* and *T. angustifolia*), and pond-weeds (*Potamogeton* spp.).

3.6.1.2 Plant Species of Concern. The Washington State Department of Natural Resources, Natural Heritage Program classifies rare plants in the State of Washington in three different categories, depending on the overall distribution of the taxon and the state of its natural habitat. These categories are: *Endangered*, which is a "vascular plant taxon in danger of becoming extinct or extirpated in Washington within the near future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree"; *Threatened*, which is a "vascular plant taxon likely to become endangered within the near future in Washington if factors contributing to its population decline or habitat degradation or loss continue"; and *Sensitive*, which is a taxon that is "vulnerable or declining, and could become endangered or threatened in the state without active management or removal of threats" (definitions taken from the Natural Heritage Program [1990]). Of concern to the Hanford Site, there are two Endangered taxa, two Threatened taxa, and at least eleven Sensitive taxa; these are listed in Table 3-3. All four of the Threatened and Endangered taxa are presently candidates for the Federal Endangered Species List.

Of the two Endangered taxa, persistantsepal yellowcress is well documented along the banks of the Columbia River throughout the 100 Areas, it is unlikely to occur in the 200 Areas. The northern wormwood is known in the state of Washington by only two populations, one across from The Dalles, Oregon, and the other near Beverly, Washington, just north of the Hanford Site. This taxon has not been found on the Hanford Site, but would probably occur only on rocky areas immediately adjacent to the Columbia River if it were present. Neither of the Threatened taxa listed in Table 3-2 has been observed on the Hanford Site. The Columbia milk vetch is known to be relatively common on the Yakima Firing Range, and has been documented to occur within 1.6 to 3.2 km (1 to 2 mi) to the west of the Hanford Site on both sides of Umptanum Ridge. This species could occur on the 200 Areas Plateau. Hoover's Desert Parsley inhabits the steep talus slopes near Priest Rapids Dam. Potentially, it could be found on similar slopes on Gable Mountain and Gable Butte, but has yet to be documented in these areas.

Of the Sensitive species, five are inhabitants of aquatic or moist habitats and the other six are inhabitants of dry upland habitats. Dense sedge, shining flatsedge, southern mudwort, and false pimpernel are all known to occur in the 100 Areas, especially near the B-C Area, in or near the Columbia River. Some of these species could be present in or near ponds and ditches in the 200 Areas. The few-flowered collinsia may also occur in these habitats. The gray cryptantha occurs on open dunes throughout the Hanford Site. Piper's daisy is fairly common on Umptanum Ridge and Rattlesnake Ridge, but has also been documented in the vicinity of B Pond, the 216-A-24 Crib, and 100-H Area. Bristly cryptantha and dwarf evening-primrose have been found at the south end of the White Bluffs, approximately 3.2 km (2 mi) upstream from the 300 Area. The "Palouse" milk vetch and coyote tobacco are not as well documented but are known to inhabit dry sandy areas such as the 200 Areas Plateau.

In addition to the three classifications for species of concern listed above, the Natural Heritage Program also maintains a "Monitor" list, which is divided into three groups. Group 1 consists of taxa in need of further field work before a formal status can be assigned. The tooth-sepal dodder (*Cuscuta denticulata*), which has been found in the state of Washington only on the Hanford Site is the only taxon in this group that is of concern to Hanford operations. This parasitic species has been found in the area west of McGee Ranch. Group 2 of the Monitor list includes species with unresolved taxonomic questions. Thompson's sandwort (*Arenaria franklinii* var. *thompsonii*) is of concern to Hanford operations. However, the representatives of this species in the state of Washington are now believed to all be variety *franklinii* which is not considered particularly rare. Group 3 of the Monitor list includes taxa that are either more abundant or less threatened than previously believed. There are approximately 15 taxa on the Hanford Site that are included on this list.

3.6.1.3 Fauna of the 200 Areas Plateau. The mammals, birds, reptiles, amphibians inhabiting the 200 Areas Plateau are discussed below.

3.6.1.3.1 Mammals. The largest mammal occurring on the 200 Area Plateau is the mule deer (*Odocoileus hemionus*). Although mule deer are much more common to riparian sites along the Columbia River they are frequently observed foraging throughout the 200 Areas. Elk (*Cervus elaphus*) also occur at Hanford but they have only been observed at the Arid Lands Ecology Reserve. Other mammal species common to the 200 Areas include badgers (*Taxidea taxus*), coyotes (*Canis latrans*), blacktail jackrabbits (*Lepus californicus*), Townsend ground squirrels (*Spermophilus townsendii*), Great Basin pocket mice (*Perognathus parvus*), pocket gophers (*Thomomys talpoides*), and deer mice (*Peromyscus maniculatus*). Badgers are known for their digging capability and have been implicated several times for encroaching into inactive burial grounds throughout the 200 Areas. The majority of the badger excavations in the 200 Areas are a result of badgers searching for prey (mice and ground squirrels). Coyotes are the principal predators, consuming such prey as rodents, insects, rabbits, birds, snakes and lizards. The Great Basin pocket mouse is the most abundant small mammal, which thrives in sandy soils and lives entirely on seeds from native and revegetated plant species. Townsend ground squirrels are not abundant in the 200 Areas but they have been seen at several different sites. Other small mammals that occur in low numbers include the Western harvest mouse (*Reithrodontomys megalotis*) and the grasshopper mouse (*Onychomys leucogaster*). Mammals associated more closely with buildings and facilities include Nuttall's cottontails (*Sylvilagus nuttallii*), house mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), and some bat species. Bats probably play a minor role in the 200 Areas' ecosystem but no documentation is available on bat populations at Hanford. Mammals such as skunks (*Mephitis mephitis*), raccoons (*Procyon lotor*), weasels (*Mustela* spp.), porcupines (*Erethizon dorsatum*), and bobcats (*Lynx rufus*) have only been observed on very few occasions.

3.6.1.3.2 Birds. Over 235 species of birds have been documented to occur at the Hanford Site (Landeen et al. 1991). At least 100 of these species have been observed in the 200 Areas. The most common passerine birds include starlings (*Sturnus vulgaris*), horned larks (*Ermophila alpestris*), meadowlarks (*Sturnella neglecta*), western kingbirds (*Tyranus virticalis*), rock doves (*Columba livia*), barn swallows (*Hirundo rustica*), cliff swallows (*Hirundo pyrrhonota*), black-billed magpies (*Pica pica*) and ravens (*Corvus corax*). Common raptors include the Northern harrier (*Circus cyaneus*), American kestrel (*Falco sparvarius*), and Red tailed hawk (*Buteo jamaicensis*). Swainson's hawks (*Buteo swainsoni*) sometimes nest in the trees located at some of the army bunker sites that were used in the 1940's. Golden eagles (*Aquila chrysaetos*) are observed infrequently. Burrowing owls (*Athene cunicularia*) nest at several locations throughout the 200 Areas. The most common upland game birds found in the 200 Areas are California quail (*Callipepla californica*) and Chukar partridge (*Alectoris chukar*), however, ring-necked pheasants (*Phasianus colchicus*) and gray partridge (*Pertx perdix*) may be found in limited numbers. The only native game bird common to the 200 Areas Plateau is the mourning dove (*Zenaida macrora*) which migrates south each fall. Other species of note which nest in undisturbed sagebrush habitats in the 200 Areas include sage sparrows (*Amphispiza belli*), and loggerhead shrikes (*Lanius ludovicianus*). Long-billed curlews (*Numenius americanus*) also use the sagebrush areas and revegetated burial grounds for nesting and foraging.

Waterfowl and aquatic birds inhabit 216-B-3 Pond and other areas where there is running or standing water. However many of these areas such as 216-A-29 Ditch are becoming more scarce due to stabilization and remedial action cleanup activities. Aquatic birds and waterfowl common to 216-B-3 Pond on a seasonal basis include Canada geese (*Branta canadensis*), American coot (*Fulica americana*), mallard (*Anas platyrhynchos*), ruddy duck (*Oxyura jamaicensis*), redhead (*Aythya americana*), bufflehead (*Bucephala albeola*) and great blue heron (*Ardea herodius*).

3.6.1.3.3 Reptiles and Amphibians. Common reptiles include gopher snakes (*Pituophis melanoleucus*) and sideblotched lizards (*Uta stansburiana*). Other reptiles and amphibians that are infrequently observed include sagebrush lizards (*Sceloporus graciosus*), horned toads (*Phryosoma douglassi*), western spadefoot toads (*Scaphiopus intermontana*) , yellow-bellied racer (*Coluber constrictor*), Pacific rattlesnake (*Crotalus viridis*), and striped whipsnake (*Masticophis taeniatus*). Both lizards and snakes are prey items of mammalian and avian predators.

3.6.1.3.4 Insects. There are hundreds of insect species which inhabit the 200 Areas. Two of the most common groups of insects include several species of darkling beetles and grasshoppers. Harvester ants are also common and have been implicated in the uptake of radionuclides from some of the burial grounds in the 200 East Area. Harvester ants have the ability to excavate and bring up material from as far down as 4.6 to 6.1 m (15 to 20 ft). Other major groups of insects include bees, butterflies and scarab beetles. Insects impact the surrounding plant community as well as serving as the prey base for many species of birds, reptiles and mammals.

3.6.1.4 Wildlife Species of Concern. Some animals that inhabit the Hanford Site have been given special status designations by the state and federal government. Some of these designations include state and federal threatened and endangered species, federal candidate, state monitor, state sensitive, and state candidate species. Species listed in Table 3-3 as state and\or federal threatened and endangered such as the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), American white pelican (*Pelecanus erythroryhnchos*), ferruginous hawk (*Buteo regalis*), and sandhill crane (*Grus canadensis*) do not inhabit the 200 Areas. The bald eagle and American white pelican utilize the Columbia River and associated habitats for roosting and feeding. Peregrine falcons and sandhill cranes fly over the Hanford Site during migration. Ferruginous hawks nest on the Hanford Site but nesting has not been documented for this species on the 200 Areas Plateau. Other species listed in Table 3-4 as state and/or federal candidates and state monitor species such as burrowing owls, Great Blue Herons, Prairie falcons (*Falco mexicanus*), Sage sparrows, and Loggerhead shrikes are not uncommon to the 200 Areas Plateau.

3.6.2 Land Use

The B Plant Aggregate Area is the location of the 221-B Building and its attendant facilities and structures. Past activities at the 221-B Building and related facilities were the extraction of plutonium from fuel rods, and later the extraction of cesium and strontium, much of which is still stored in the 225-B Building. Other buildings within the aggregate area served mainly as storage or office space. Waste management units that remain active are noted in Figure 2-1, Operational and Waste-Related History.

3.6.3 Water Use

There is no consumptive use of groundwater within the B Plant Aggregate Area. Two wells, for emergency cooling water supply, are located at the 282-B and -BA Pumphouses (Peterson 1990c). Water for drinking and emergency use, and facilities process water is drawn from the Columbia River, treated, and imported to the 200 East Area. The nearest wells used to supply drinking water are located at the Yakima Barricade (Well 699-40-100-C) about 7 km (4 mi) west of the 200 East Area; at the Hanford Safety Patrol Training Academy (Well 699-528-E0) about 40 km (24 mi) to the southeast; at the PNL Observatory (Well 6652-C); and near the Fast Flux Test Facility in the 400 Area (Well 699-S1-8J) about 32 km (19 mi) to the southeast. The nearest water supply wells located offsite are about 15 km (9.4 mi) to the northwest (upgradient). These wells obtain their water from the basalt and the basalt interbeds (the Berkshire Well and Chateau Ste. Michelle No. 1 and No. 2). The latter wells are reportedly used for irrigation although they may also be used to supply drinking water.

3.7 HUMAN RESOURCES

The environmental conditions at the B Plant Aggregate Area must be evaluated in relationship to the surrounding population centers and other human resources. A very brief summary of demography, archaeology, historical resources, and community involvement is given below.

3.7.1 Demography

There are no residences on the Hanford Site. The nearest inhabited residences are farm homes on land located 21 km (13 mi) north of the B Plant Aggregate Area. There are approximately 411,000 (1990 census) people living within a 80 km (50 mi) radius of the 200 Areas Plateau. The primary population centers are the cities of Richland, Kennewick, and Pasco, located southeast of the Hanford Site, Prosser to the south, Sunnyside to the southwest, and Benton City to the southeast.

3.7.2 Archaeology

An archaeologic survey has been conducted of undeveloped portions of the 200 East Area by the Hanford Cultural Resources Laboratory. Isolated artifacts and sites of interest were identified in the 200 West Area but not within the B Plant Aggregate Area. The closest site of interest is the remains of the White Bluffs Road, located approximately 15 km (9 mi) northwest of the aggregate area, which was previously an Indian trail.

3.7.3 Historical Resources

The only historic site in 200 East Area is the old White Bluffs freight road which crosses diagonally through the vicinity. This site is not considered to be eligible for the National Register.

3.7.4 Community Involvement

A Community Relations Plan (Ecology et al. 1989) has been developed for the Hanford Site Environmental Restoration Program that includes any potentially affected community with respect to the B Plant AAMSR. The Community Relations Plan includes a discussion on analysis of key community concerns and perceptions regarding the project, along with a list of all interested parties.

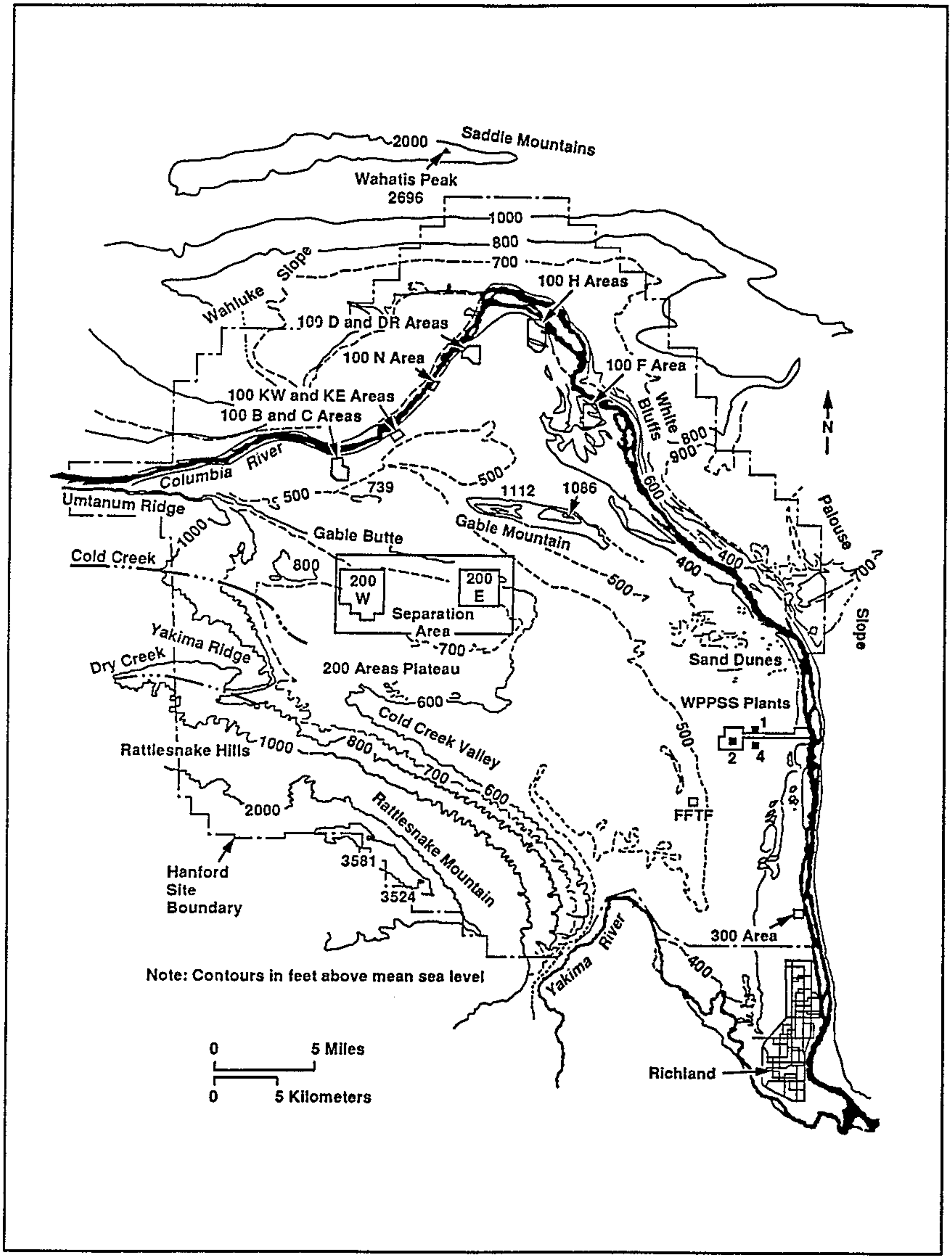


Figure 3-1. Topography and Location Map for the Hanford Site.

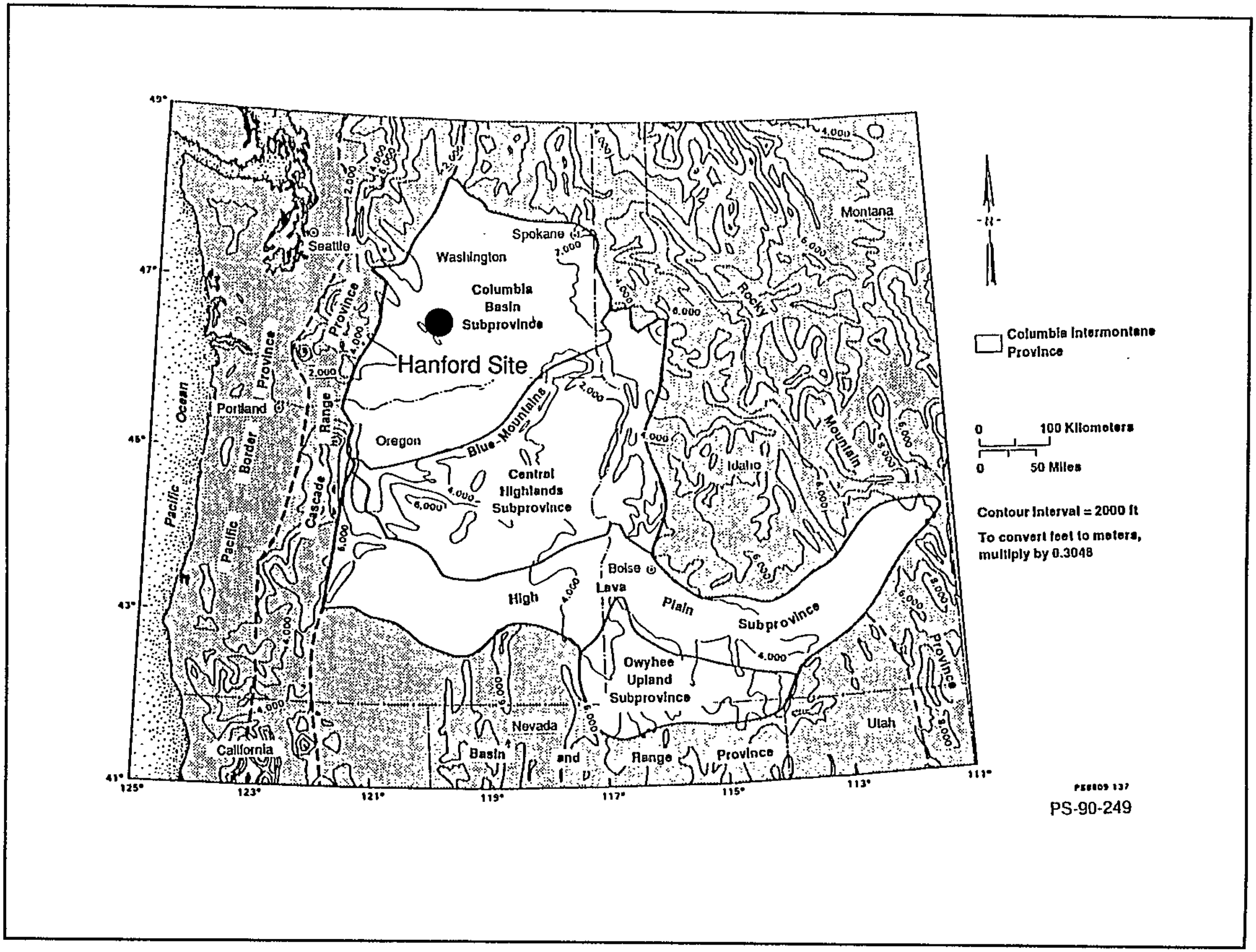


Figure 3-2. Divisions of the Columbia Intermontane Province and Adjacent Snake River Plains Province.

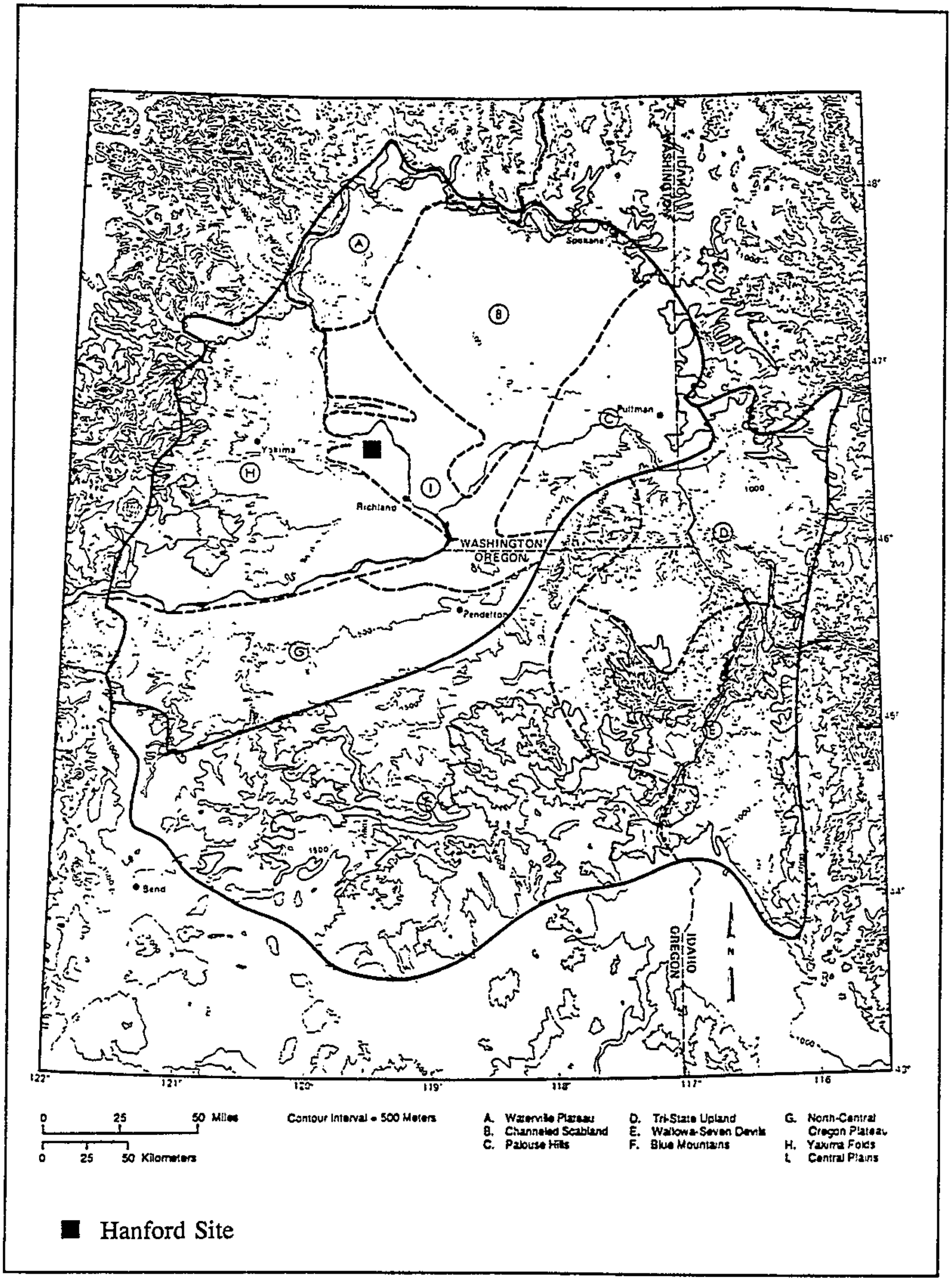


Figure 3-3. Geomorphic Units Within the Central Highlands and Columbia Basin Subprovinces that Contain the Columbia River Basalt Group (after Thornbury 1965) (Last et al. 1989).

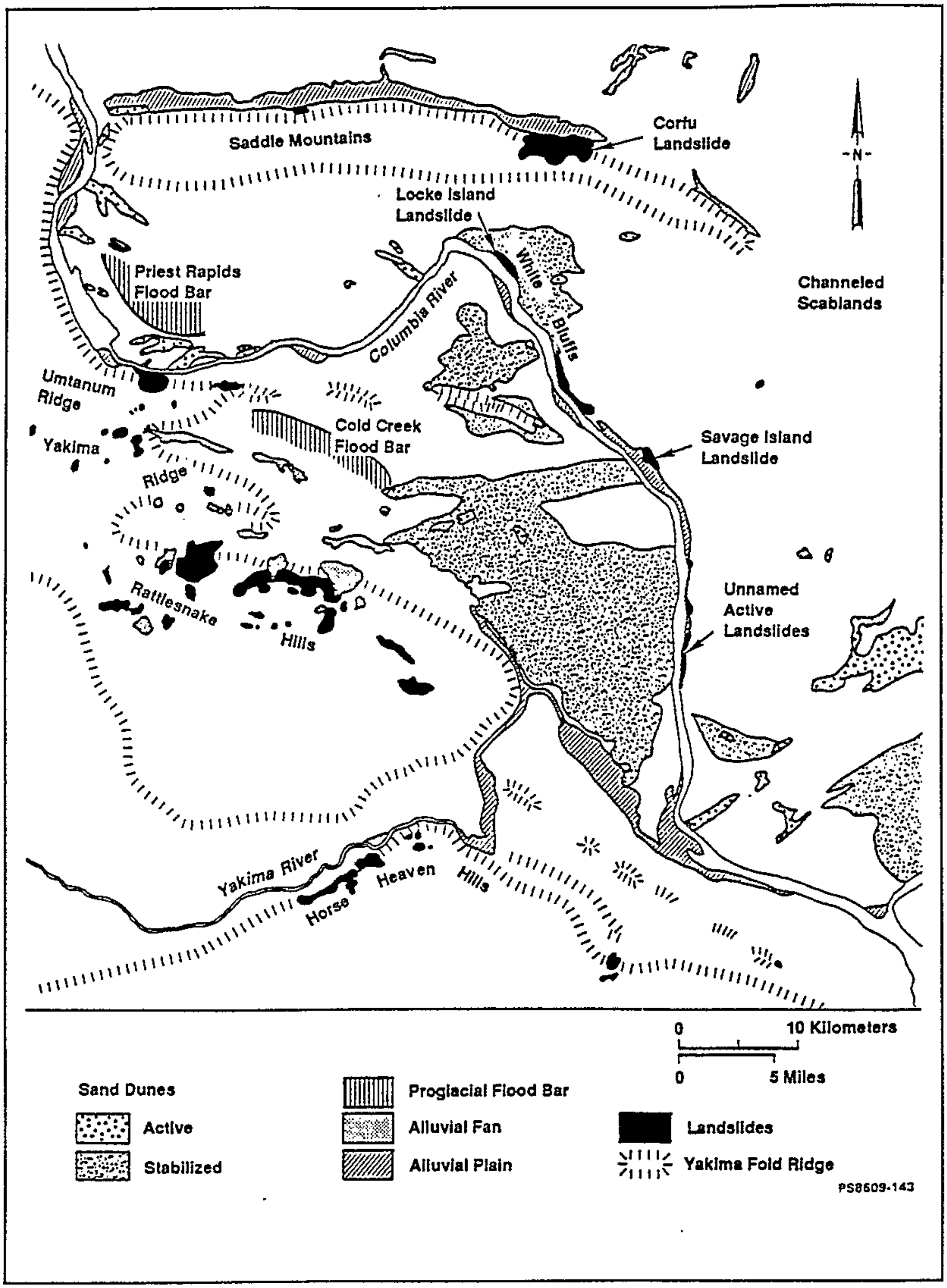


Figure 3-4. Landforms of the Pasco Basin and the Hanford Site.

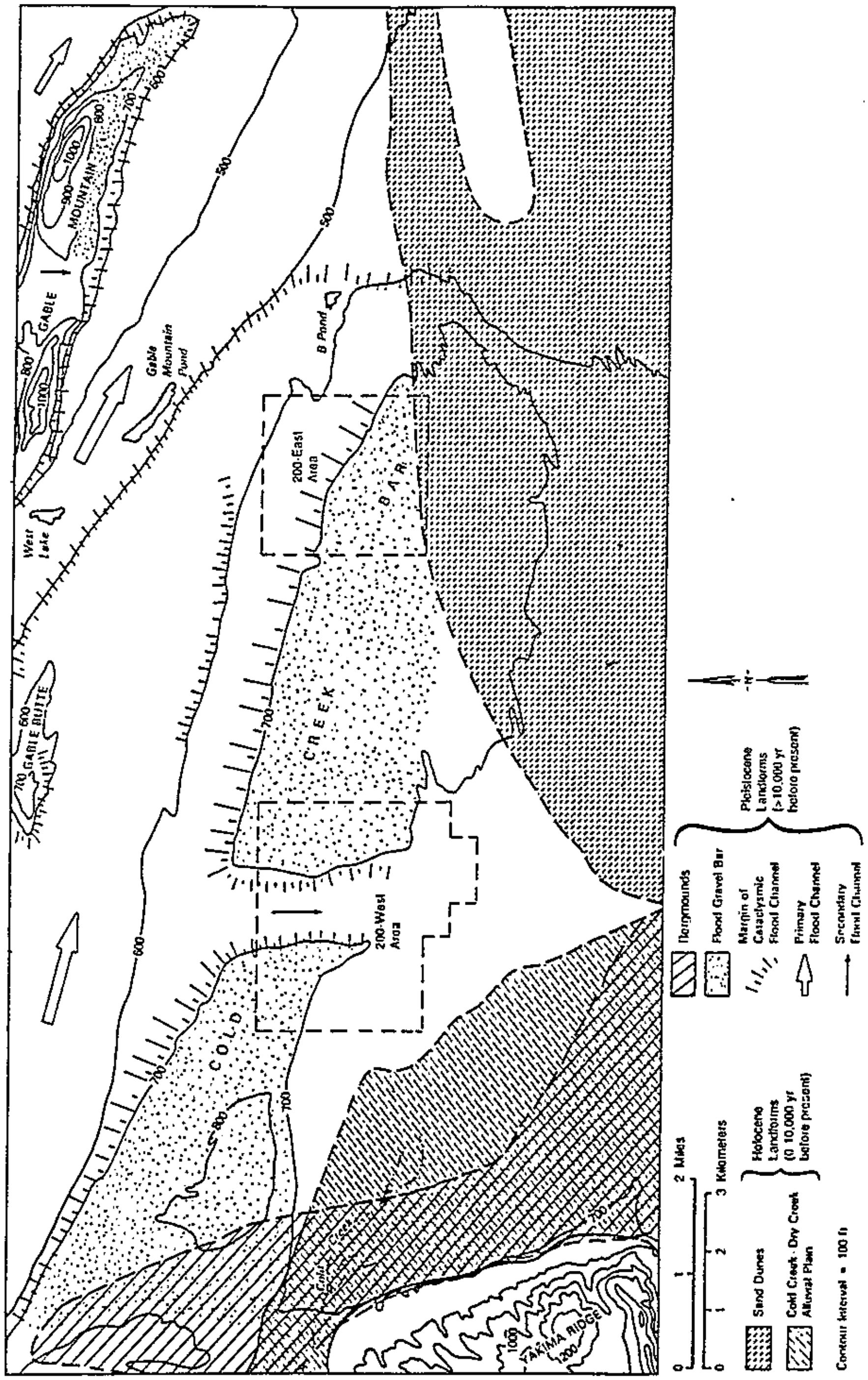


Figure 3-5. Geomorphic Features Surrounding the 200 Areas (Last et al. 1989).

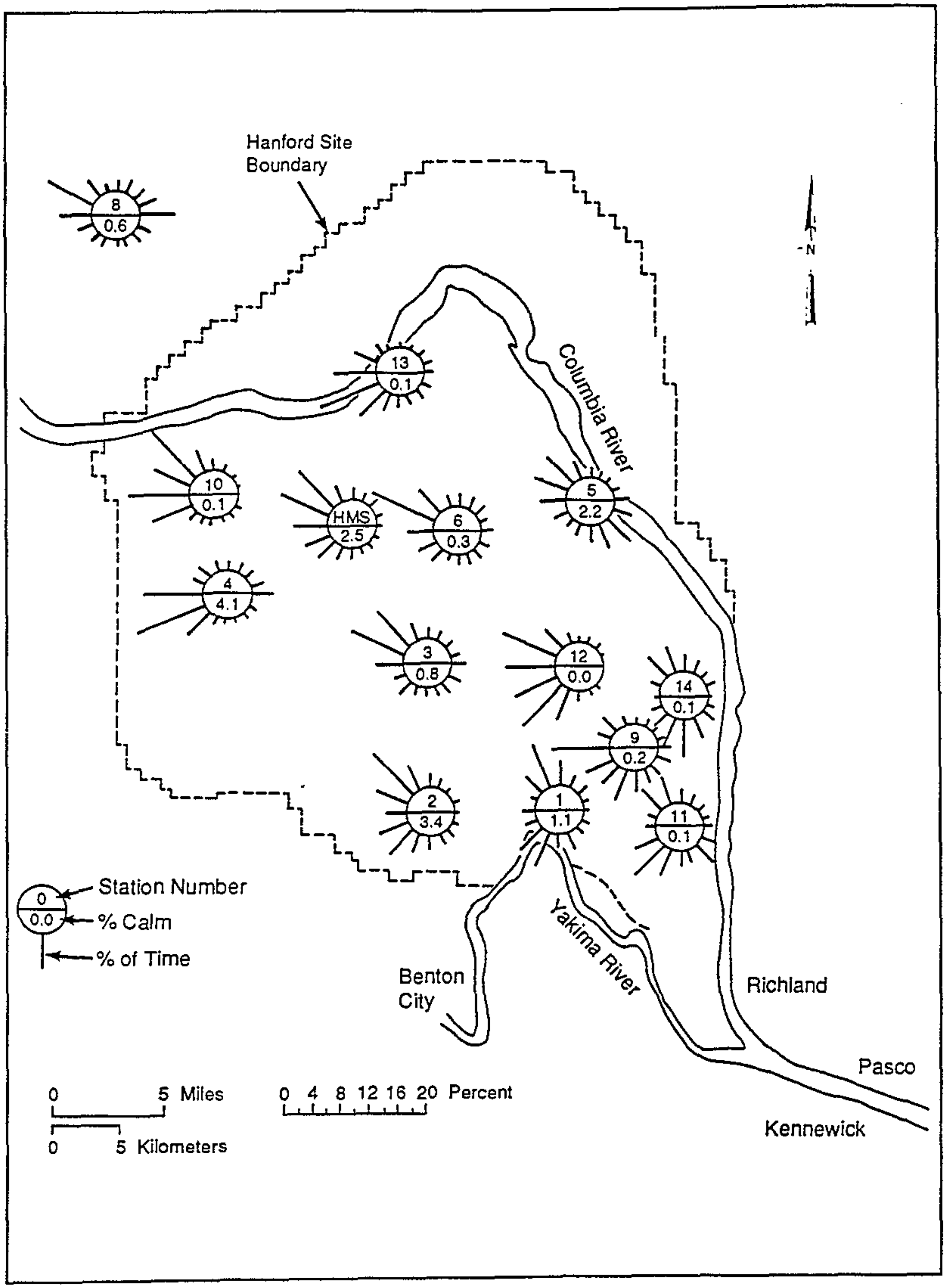


Figure 3-6. Hanford Site Wind Roses, 1979 through 1982 (Stone et al. 1983).

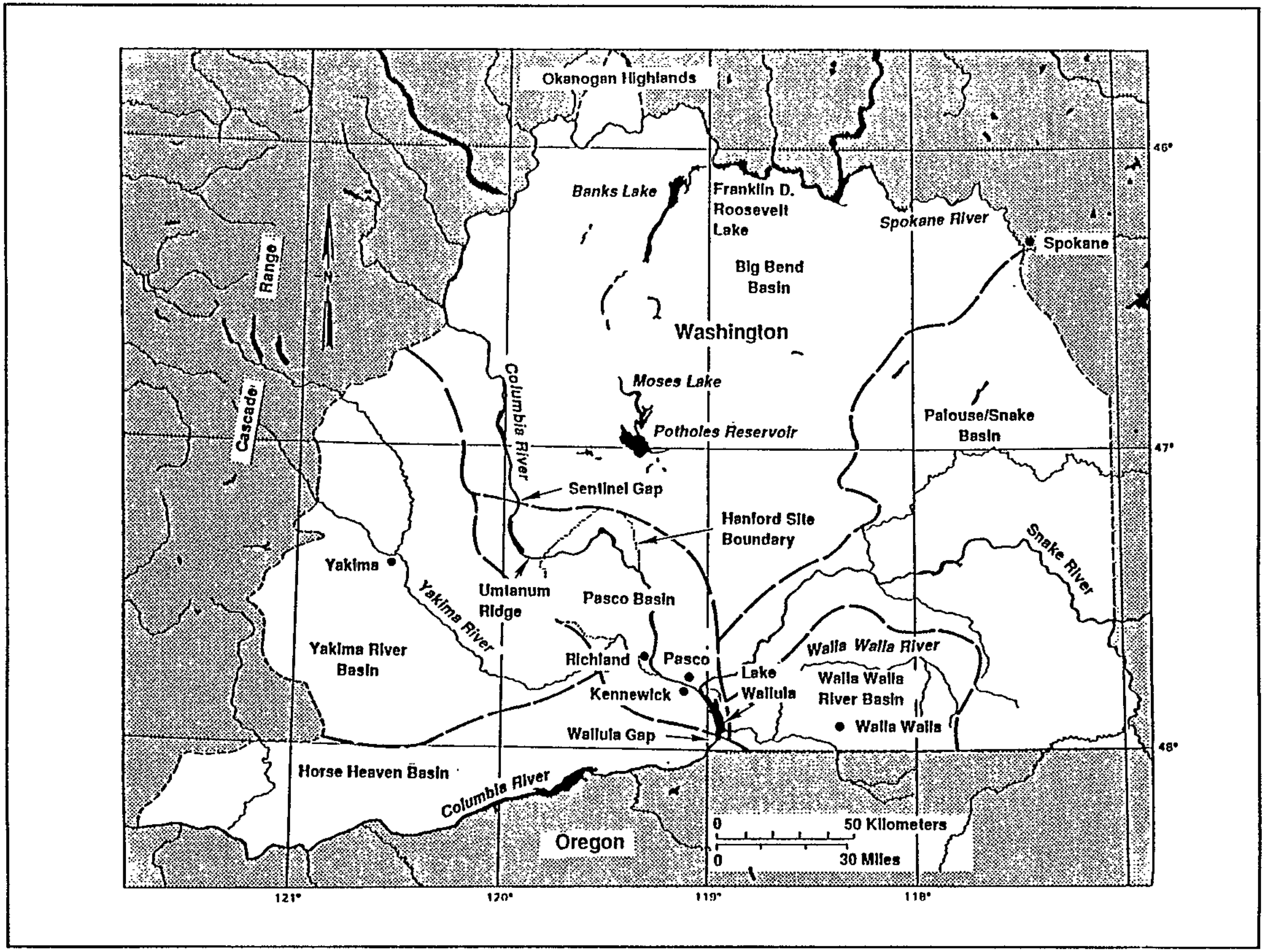


Figure 3-7. Hydrologic Basins Designated for the Washington State Portion of the Columbia Plateau (DOE 1988).

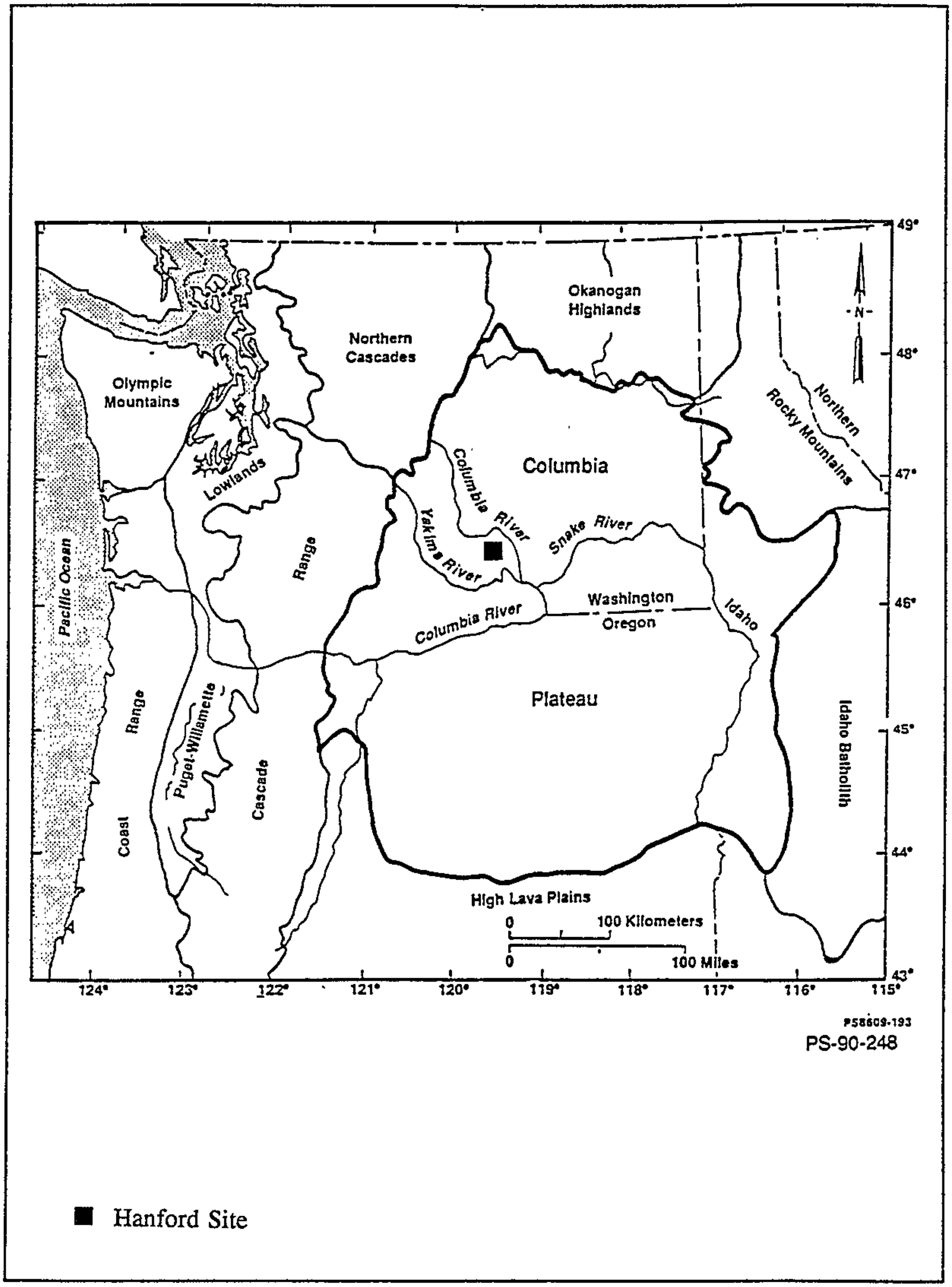


Figure 3-8. Structural Provinces of the Columbia Plateau.

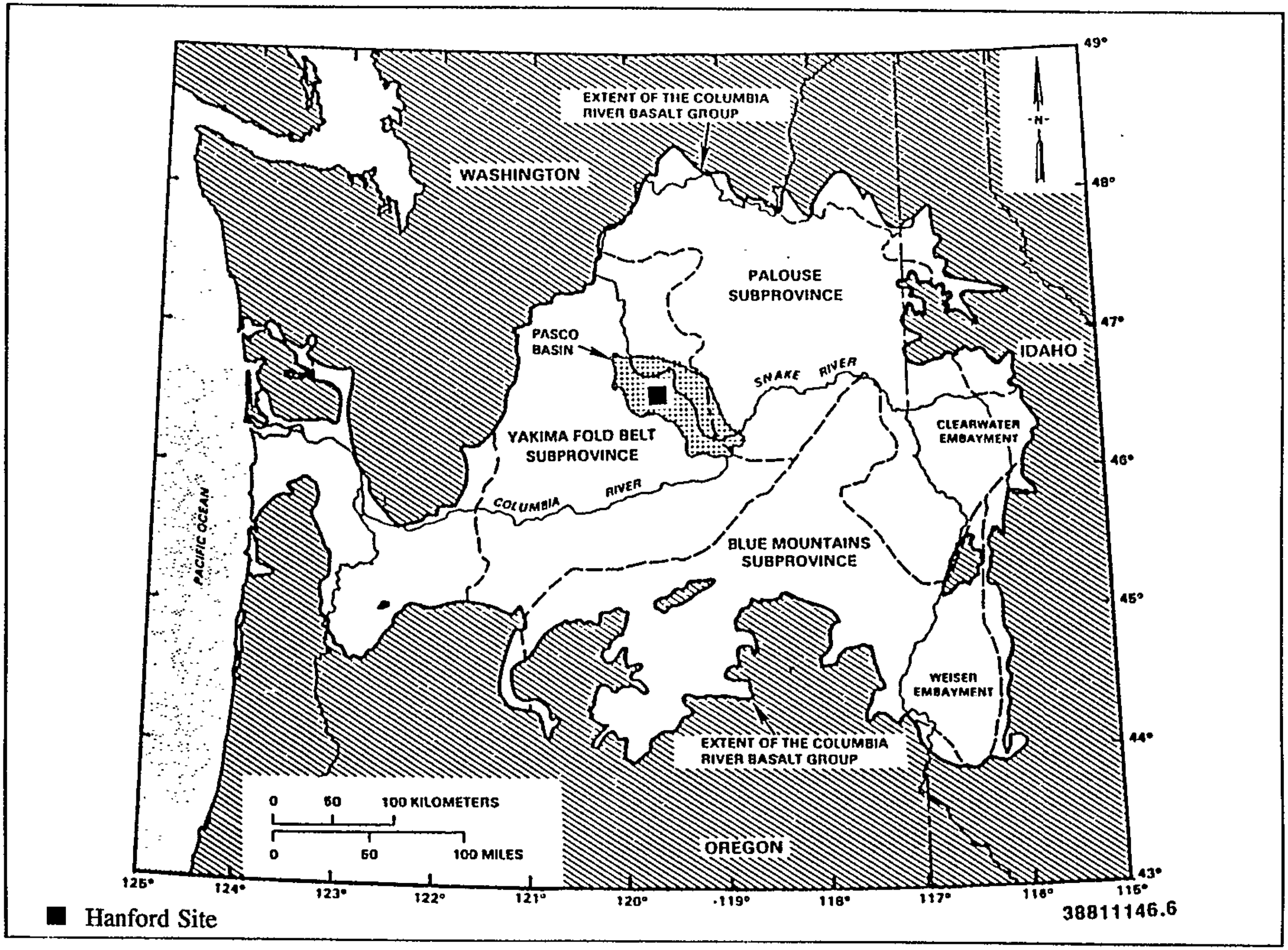


Figure 3-9. Structural Subprovinces of the Columbia Plateau (Last et al. 1989).

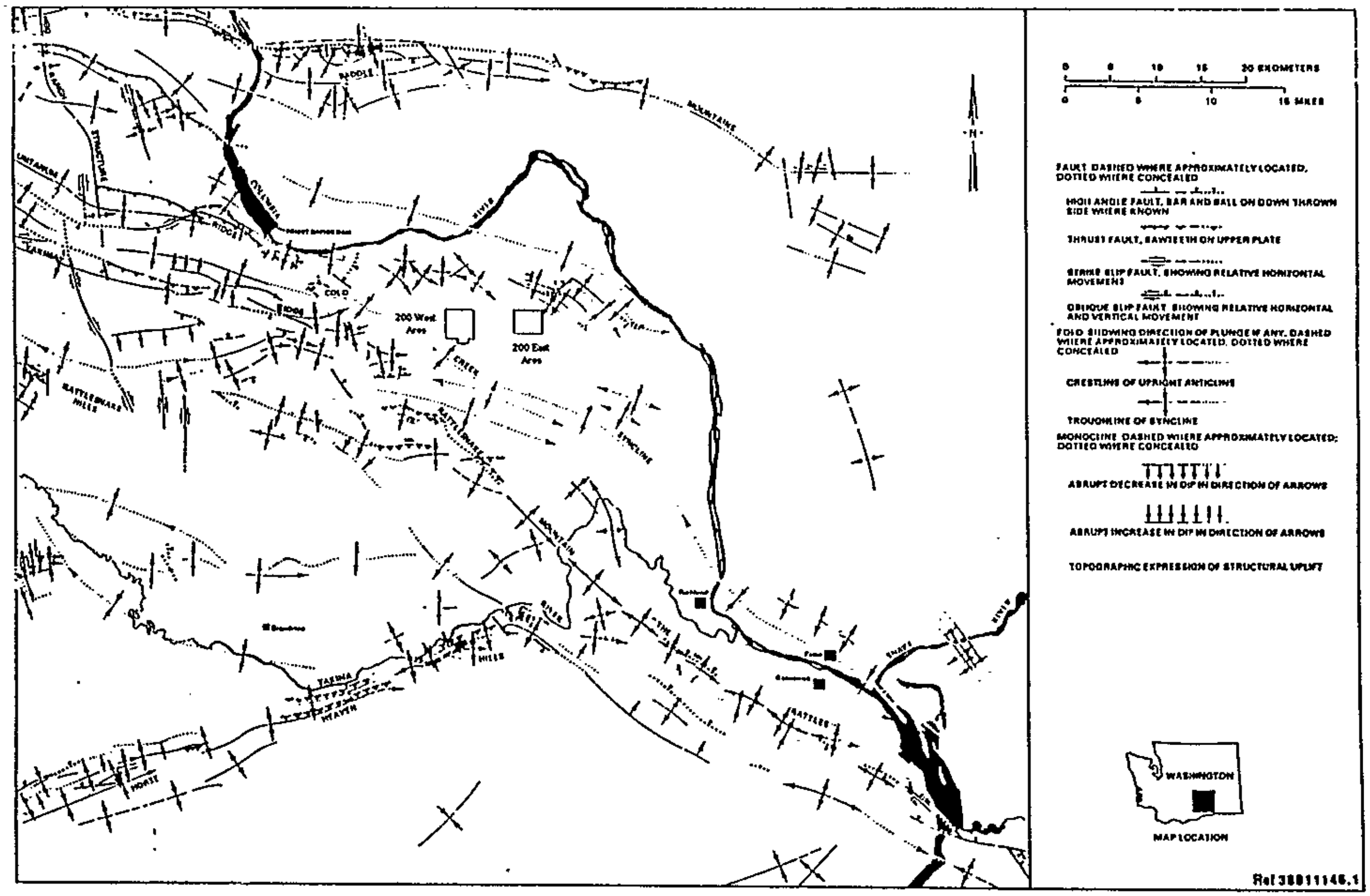


Figure 3-10. Structural Elements of the Yakima Fold Belt Subprovince (Last et al. 1989).

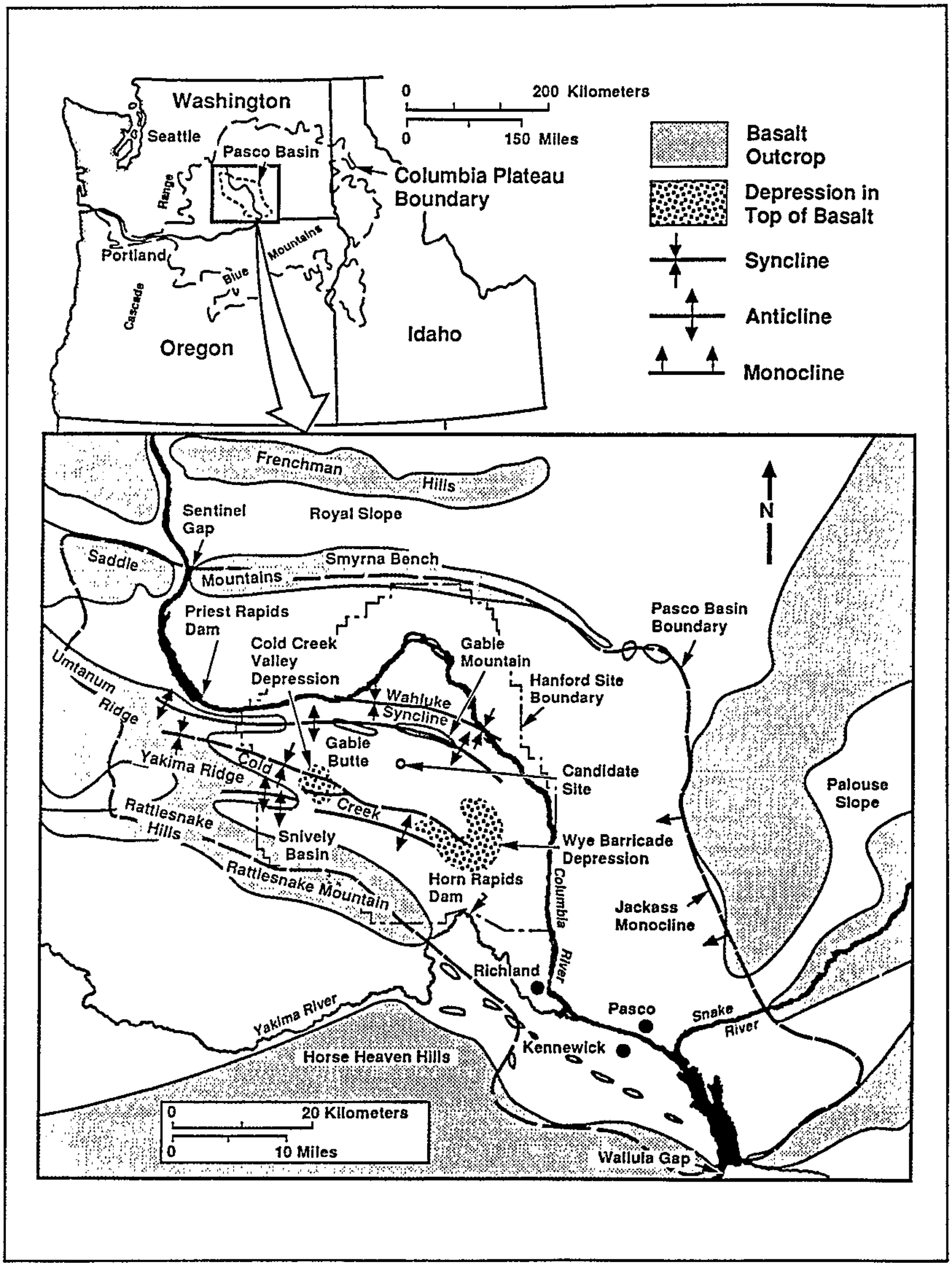
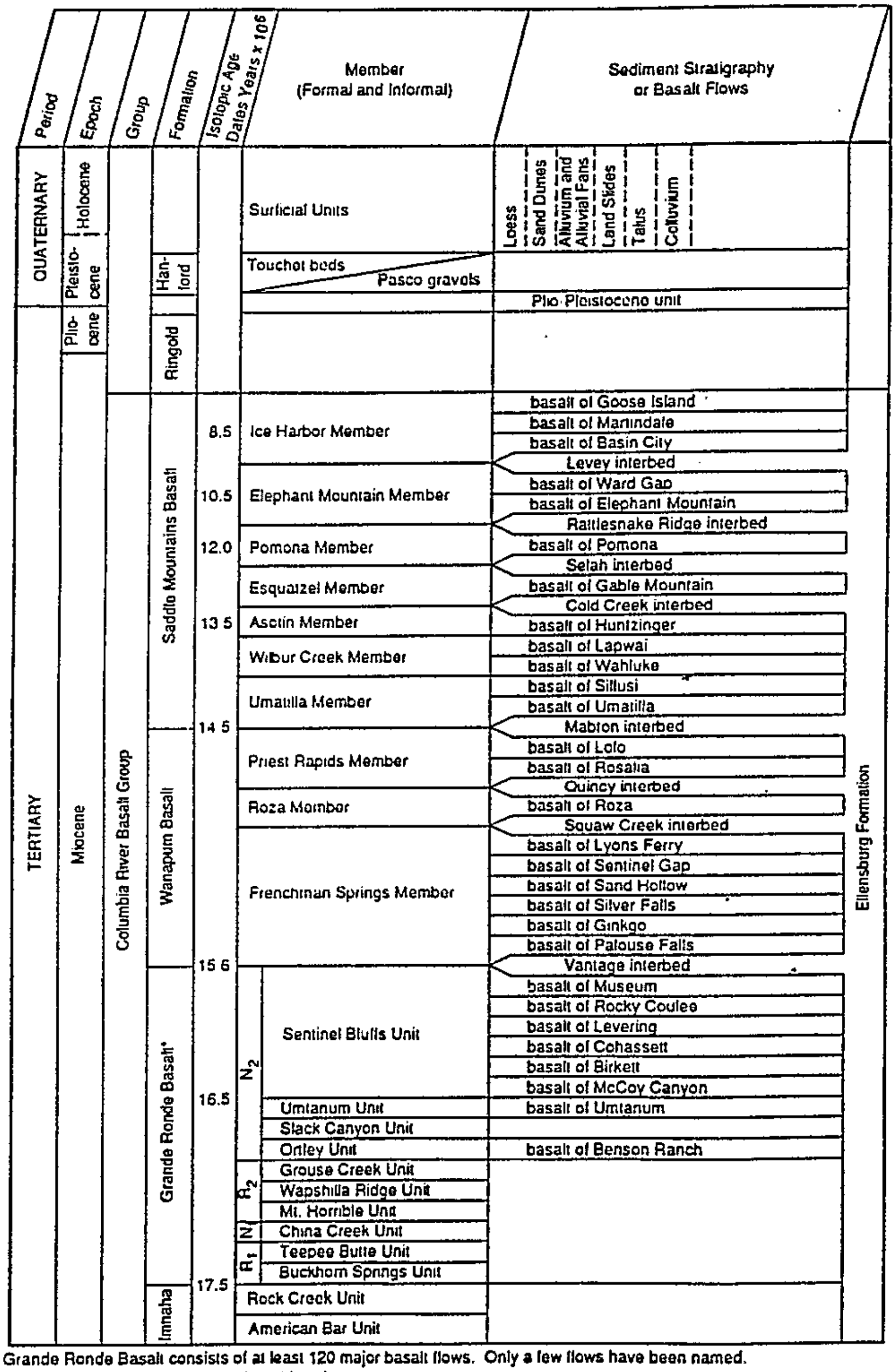


Figure 3-11. Geologic Structures of the Pasco Basin and the Hanford Site.



*The Grande Ronde Basalt consists of at least 120 major basalt flows. Only a few flows have been named.
N_2, R_2, N_1 and R_1 are magnetostratigraphic units.

H9102029.6

Figure 3-12. Generalized Stratigraphy of the Hanford Site.

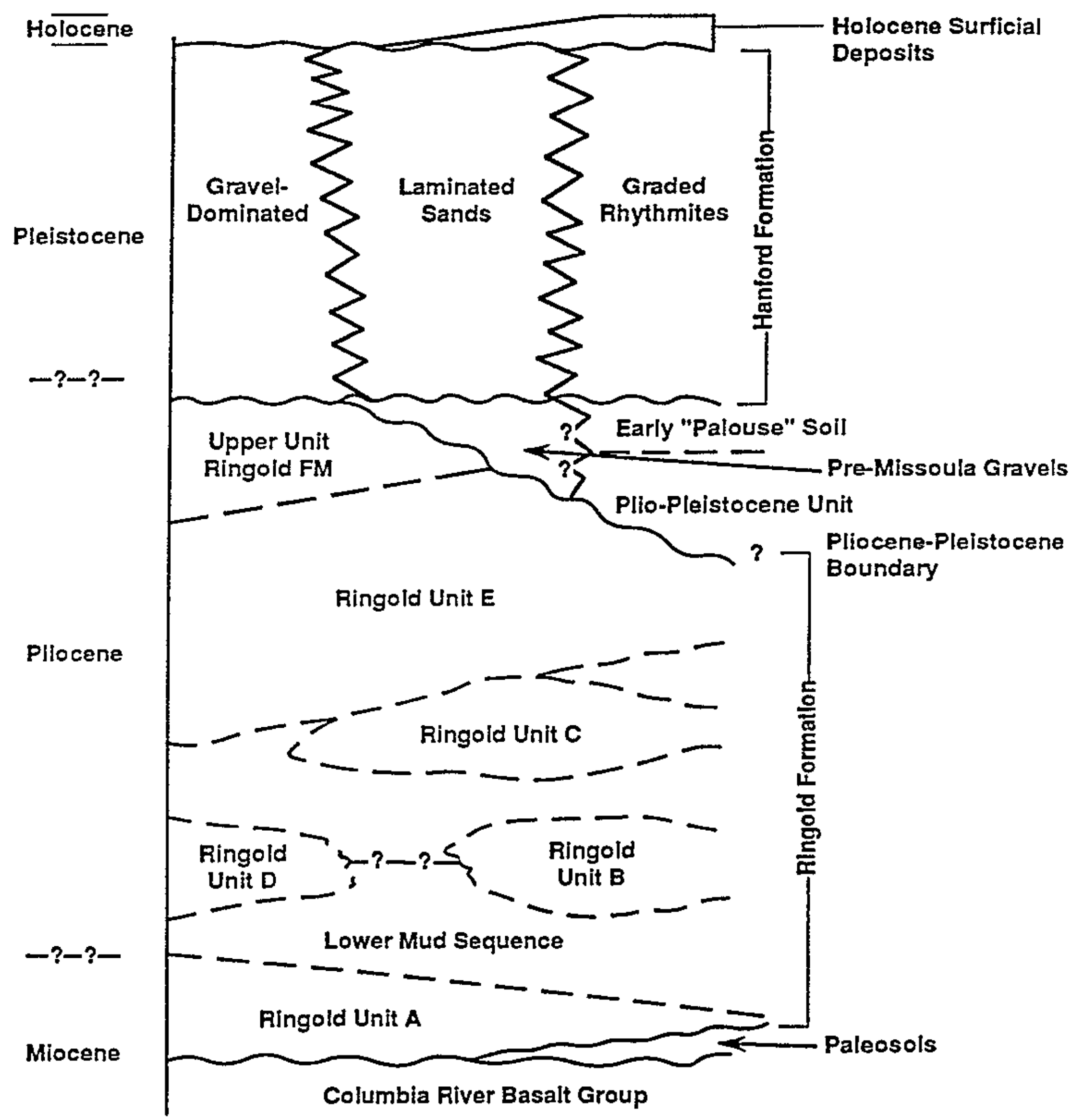


Figure 3-13. Generalized Stratigraphy of the Suprabasalt Sediments Beneath the Hanford Site.

9 2 1 2 6 5 0 3 2 0

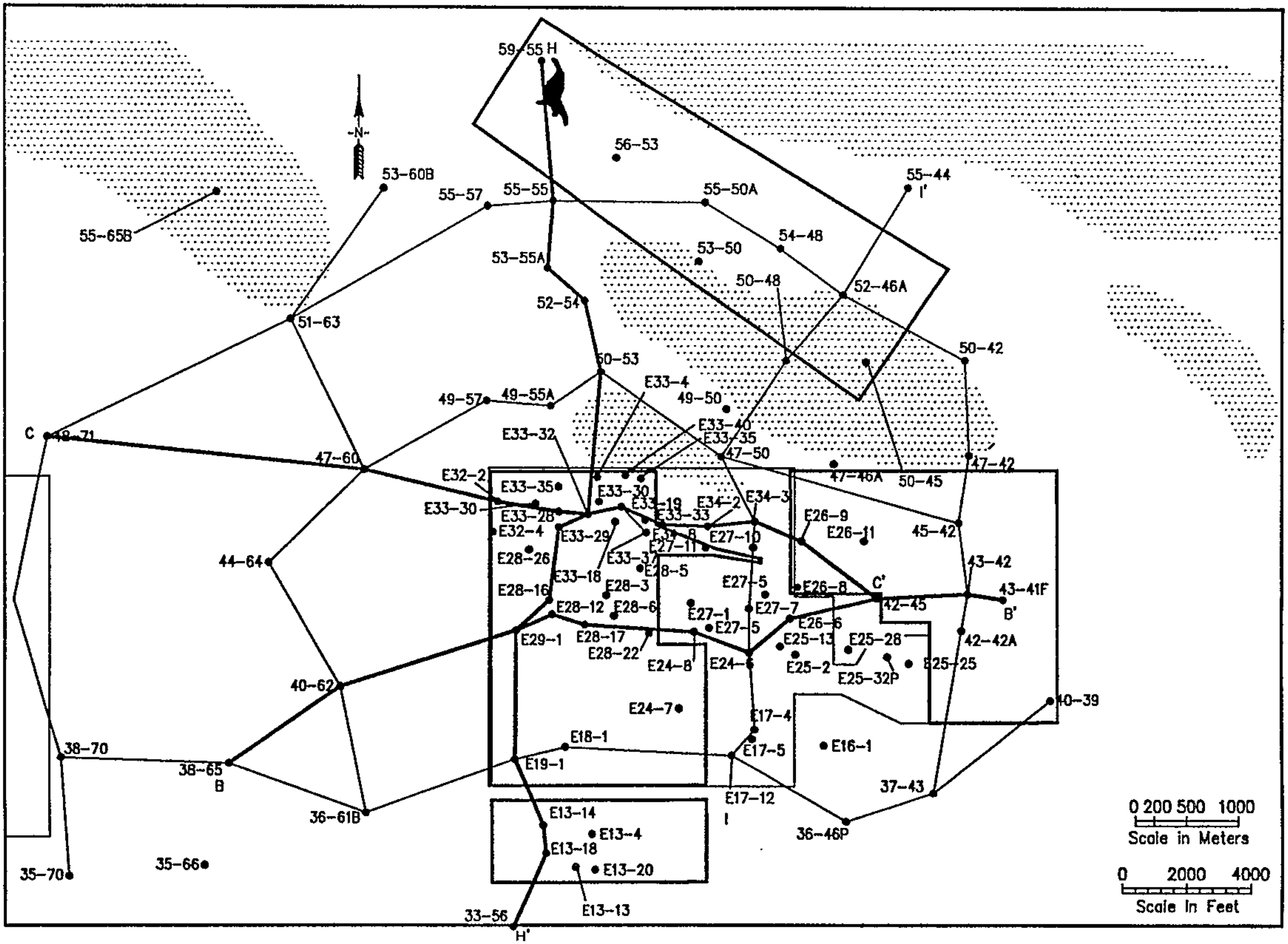


Figure 3-14. Location of Cross-sections.

GRAIN SIZE SCALE

- Cobble–boulder Gravel
- Pebble Gravel
- Sand
- Clay/Silt

UNIT ABREVIATIONS

Hc Upper Coarse Unit, Hanford formation
Hf Lower Fine Unit, Hanford formation
EP Early "Palouse" Soil
PP Plio–Pleistocene Unit
UR Upper Unit, Ringold Formation
E Gravel Unit E, Ringold Formation
LM Lower Mud Sequence, Ringold Formation
A Gravel Unit A, Ringold Formation

SYMBOLS

---?--------- Formational Contact, ? Where Inferred
— —?— — Unit Contact, ? Where Inferred
. . . . . Major Facies Contact
Pedogenic Calcium Carbonate
Paleosols
Ringold Clast Supported Gravels
Open Framework Hanford Gravels
Laminated Muds
Basalt

Blank portions of cross section well logs represent sediments (dominantly sand) which do not fit into sediment categories depicted by symbols listed above.

NOTE:
1. Refer to Figure 3-14 for cross section locations and designation. Cross sections presented on Figures 3-16 through 3-18.

2. Figures based on Lindsey et al. 1991.

Figure 3-15. Legend for Cross Sections.

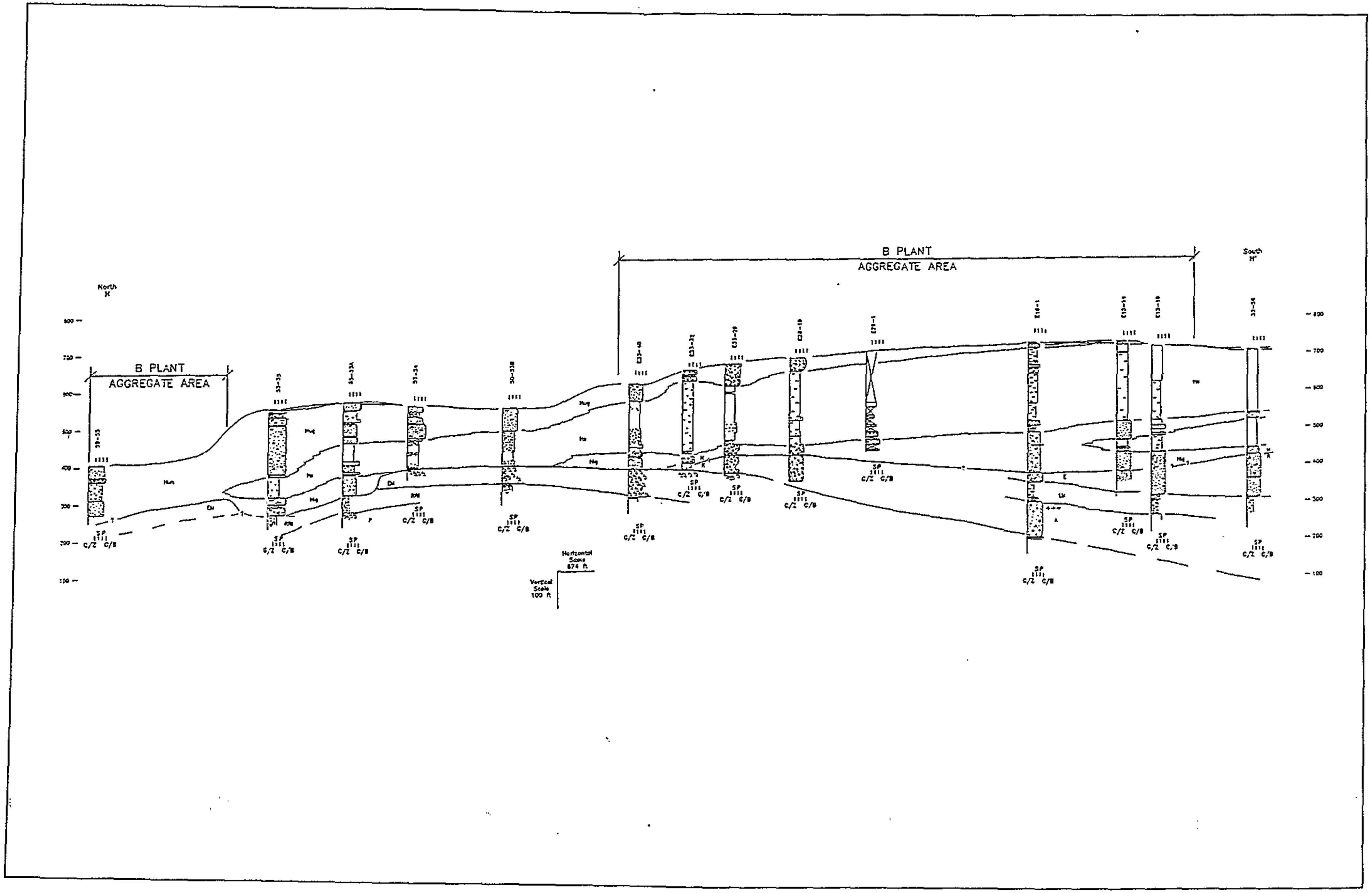


Figure 3-16. Geologic Cross-Section - H-H'.

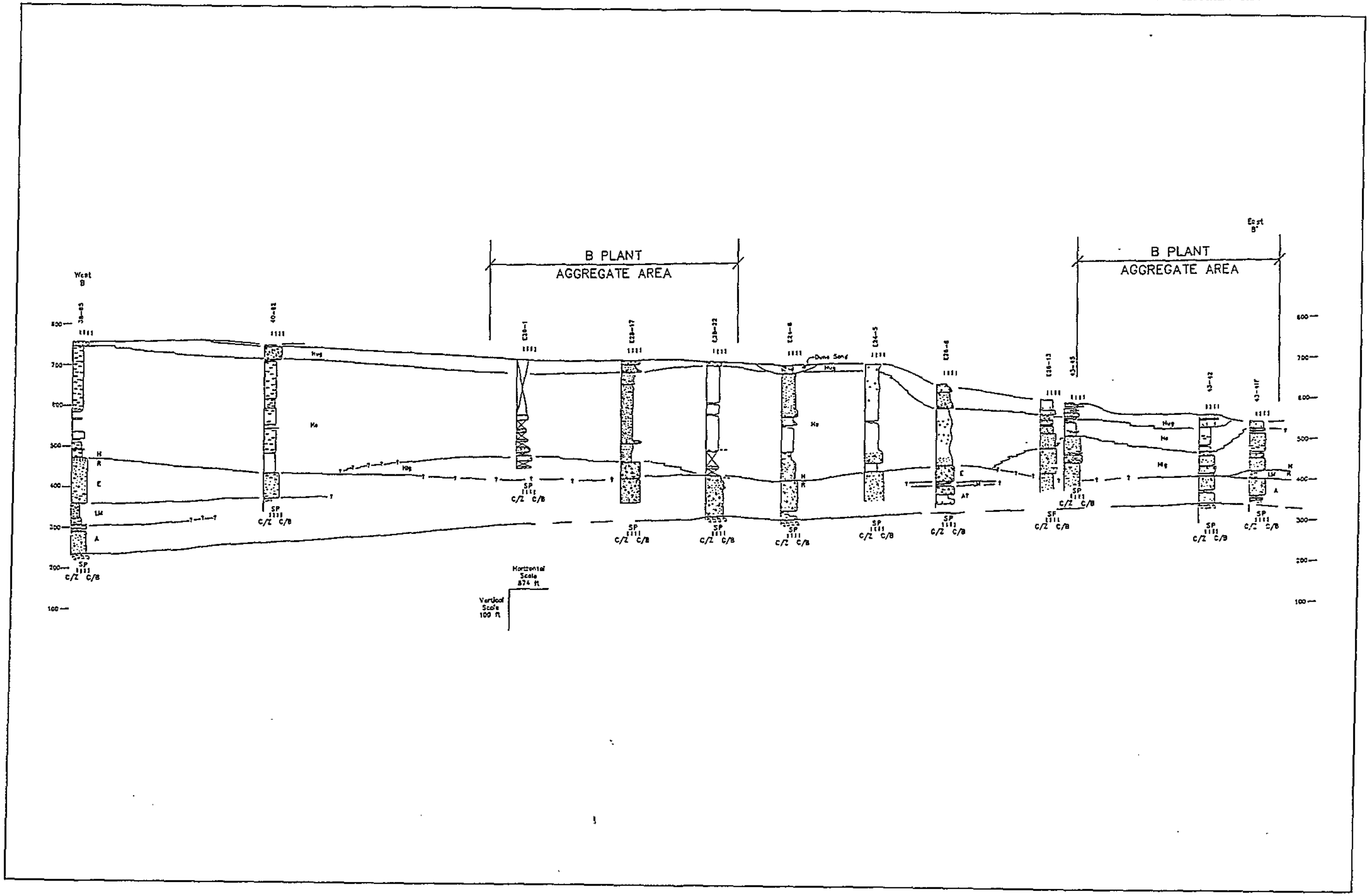


Figure 3-17. Geologic Cross-Section - B-B'.

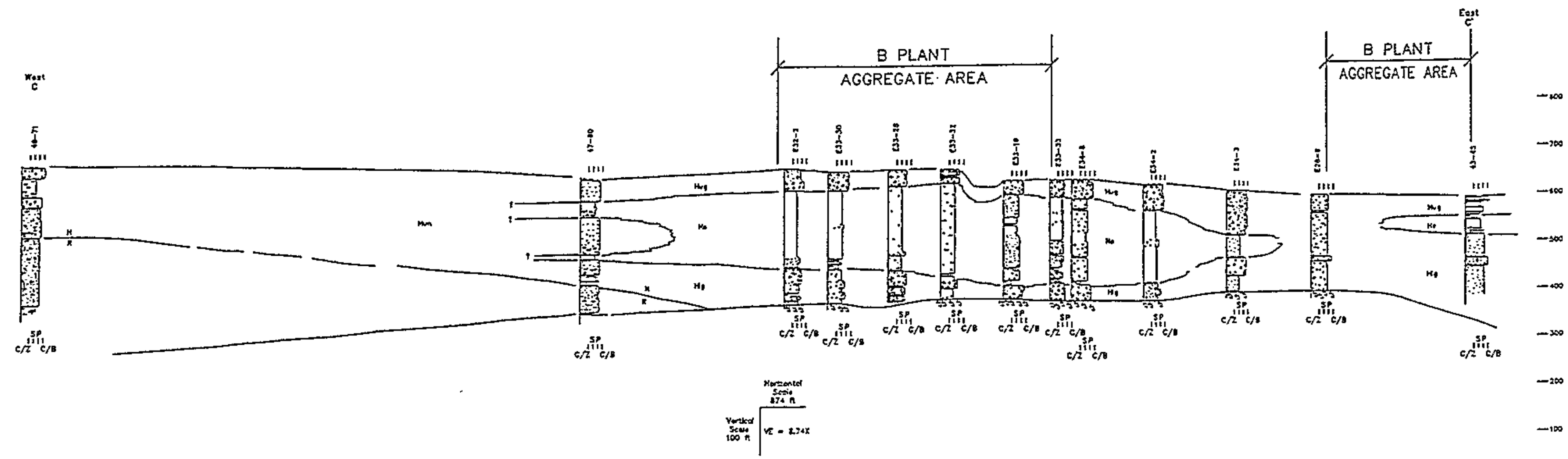


Figure 3-18. Geologic Cross-Section - C-C'.

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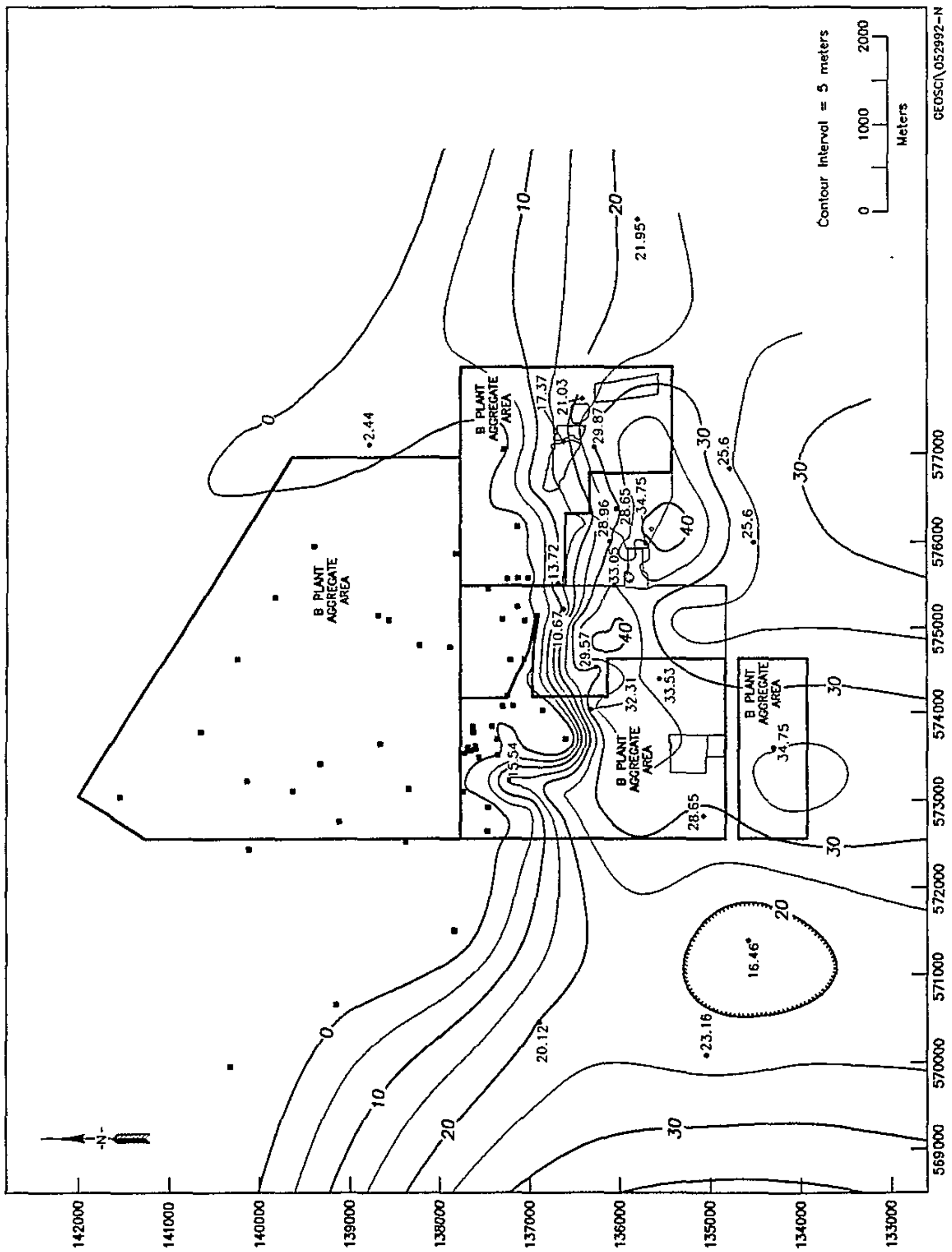

Figure 3-19. Isopach Map of the Ringold Gravel Unit A.

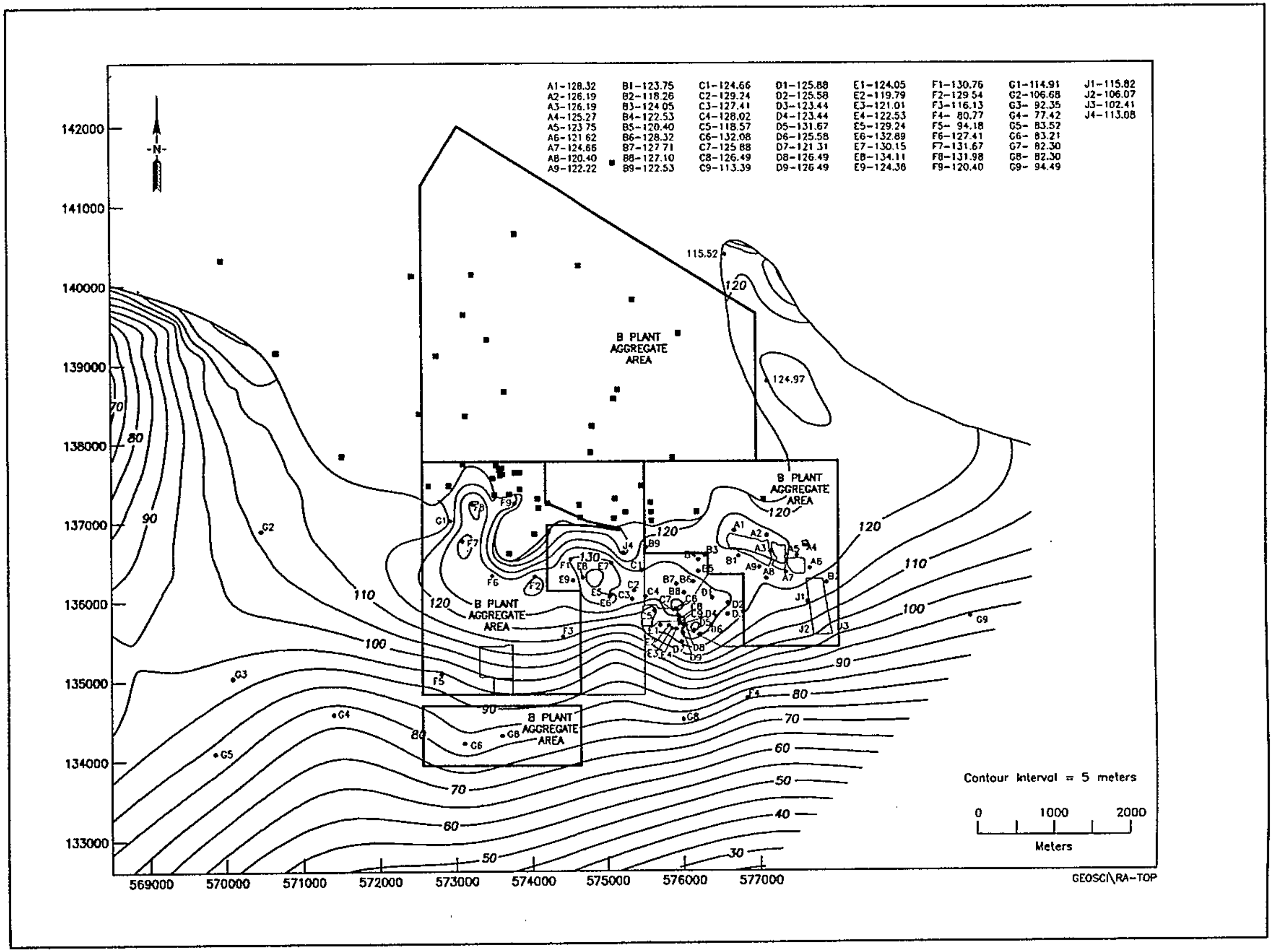

Figure 3-20. Structure Map of the Top of the Ringold Gravel Unit A.

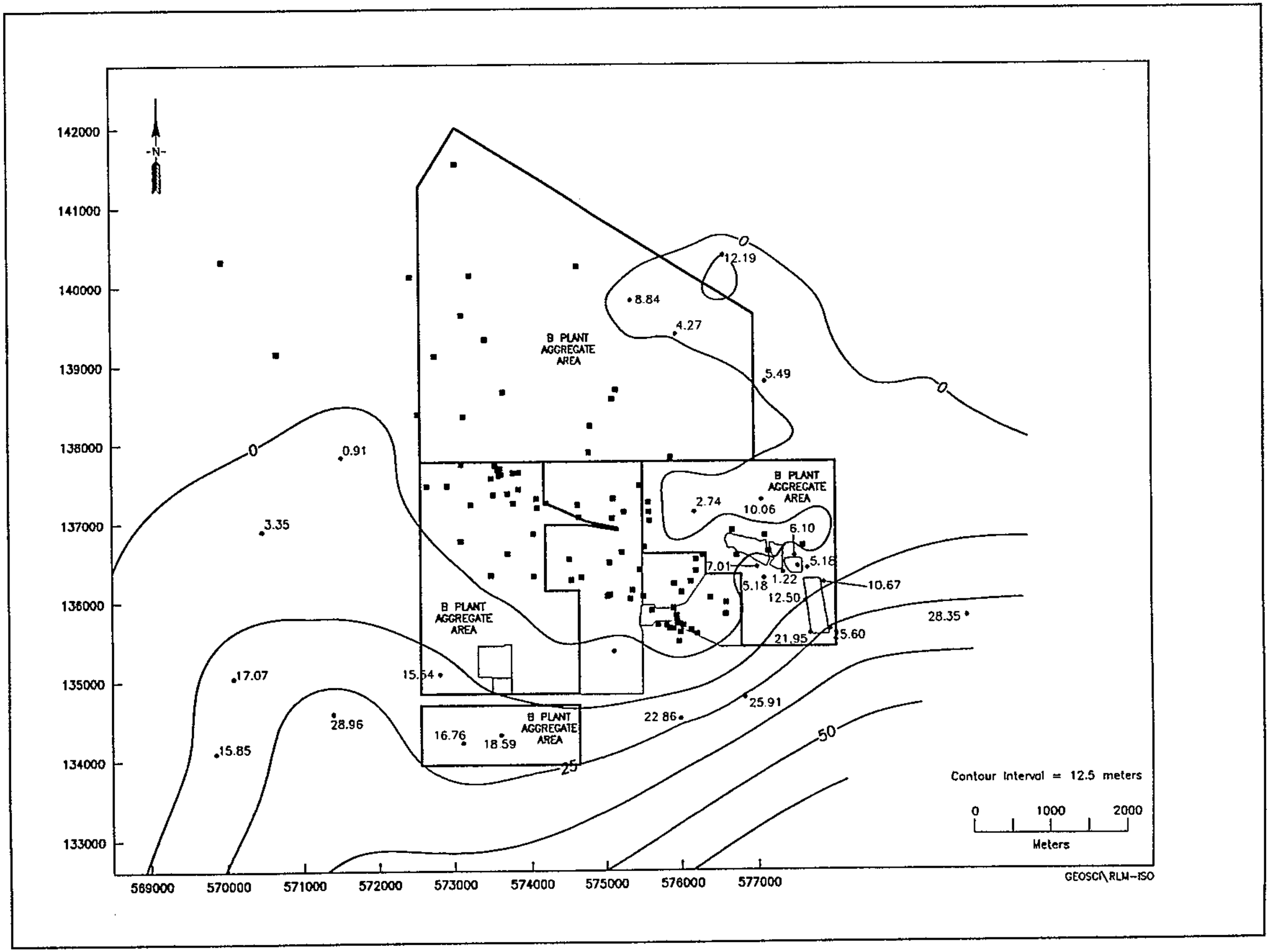

Figure 3-21. Isopach Map of the Lower Mud Sequence, Ringold Formation.

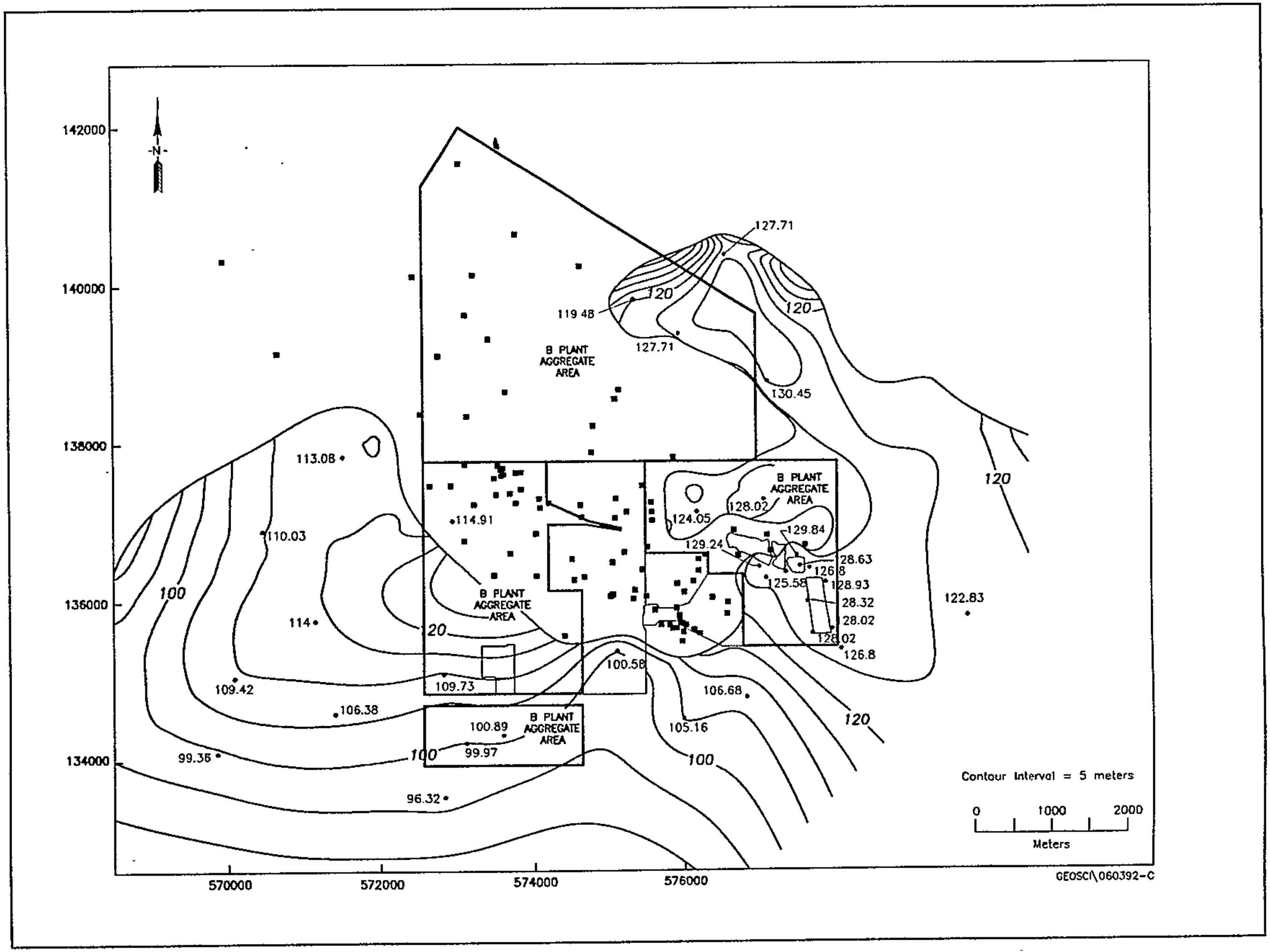

Figure 3-22. Structure Map of the Top of the Lower Mud Sequence, Ringold Formation.

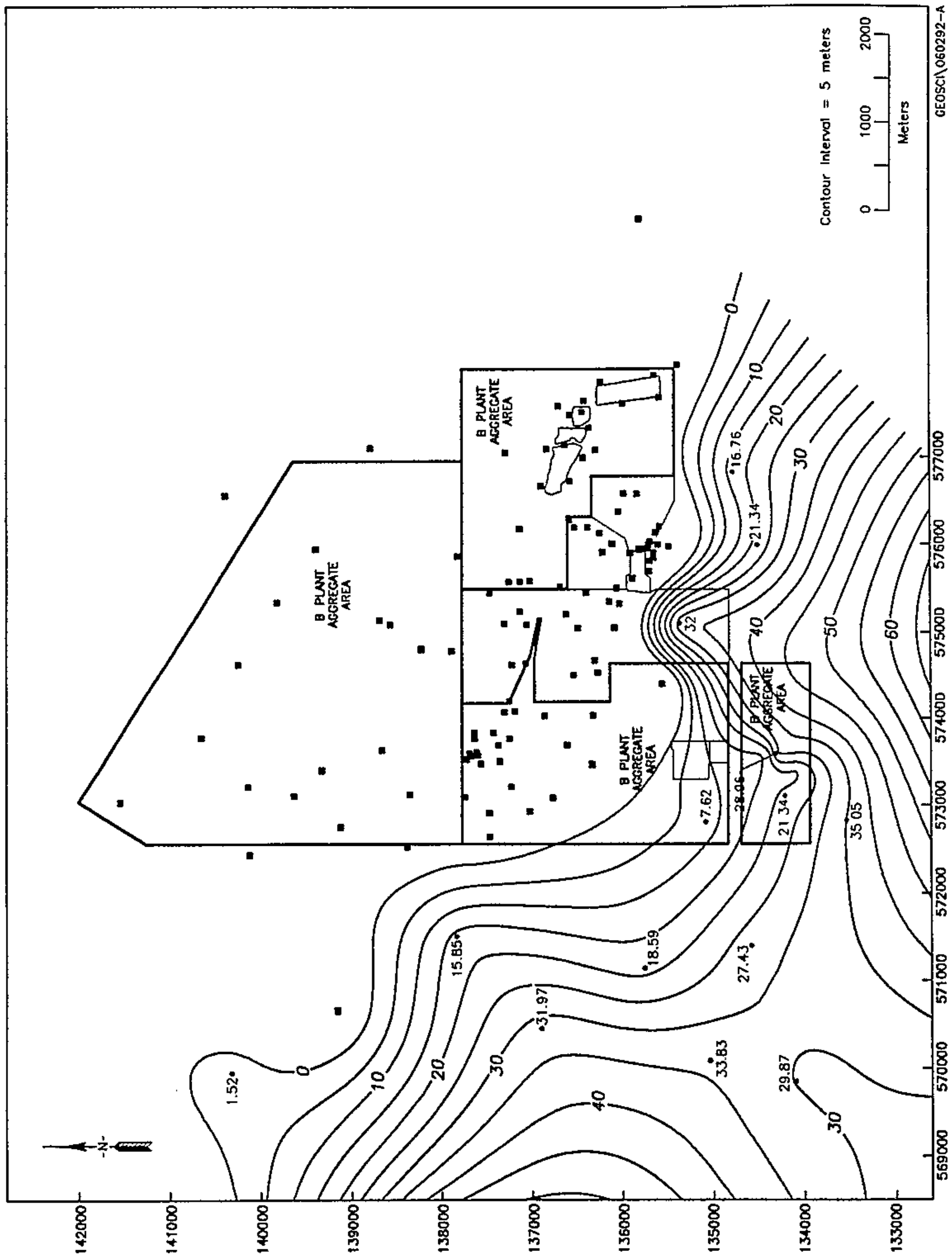

Figure 3-23. Isopach Map of the Ringold Gravel Unit E.

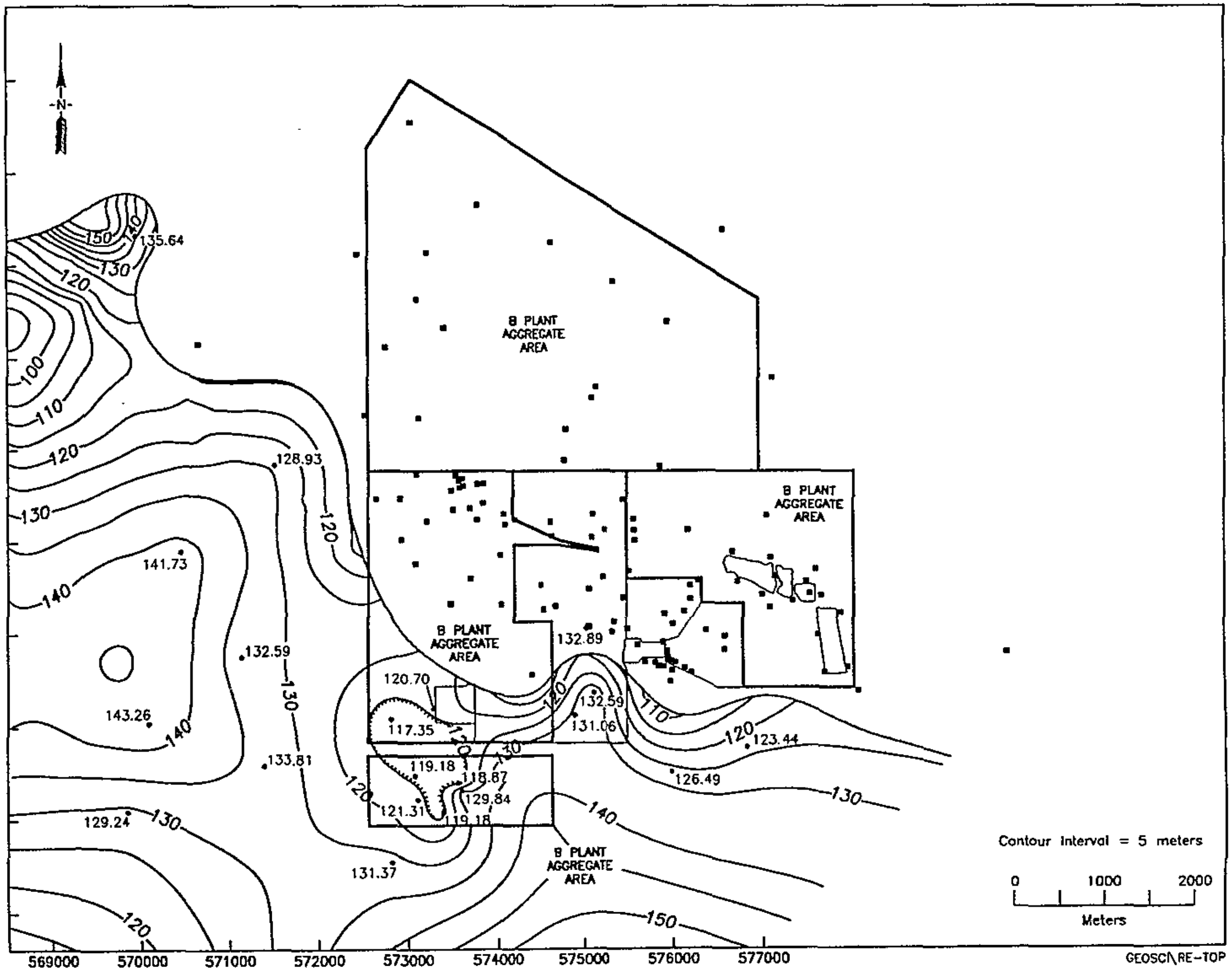

Figure 3-24. Structure Map of the Ringold Gravel Unit E.

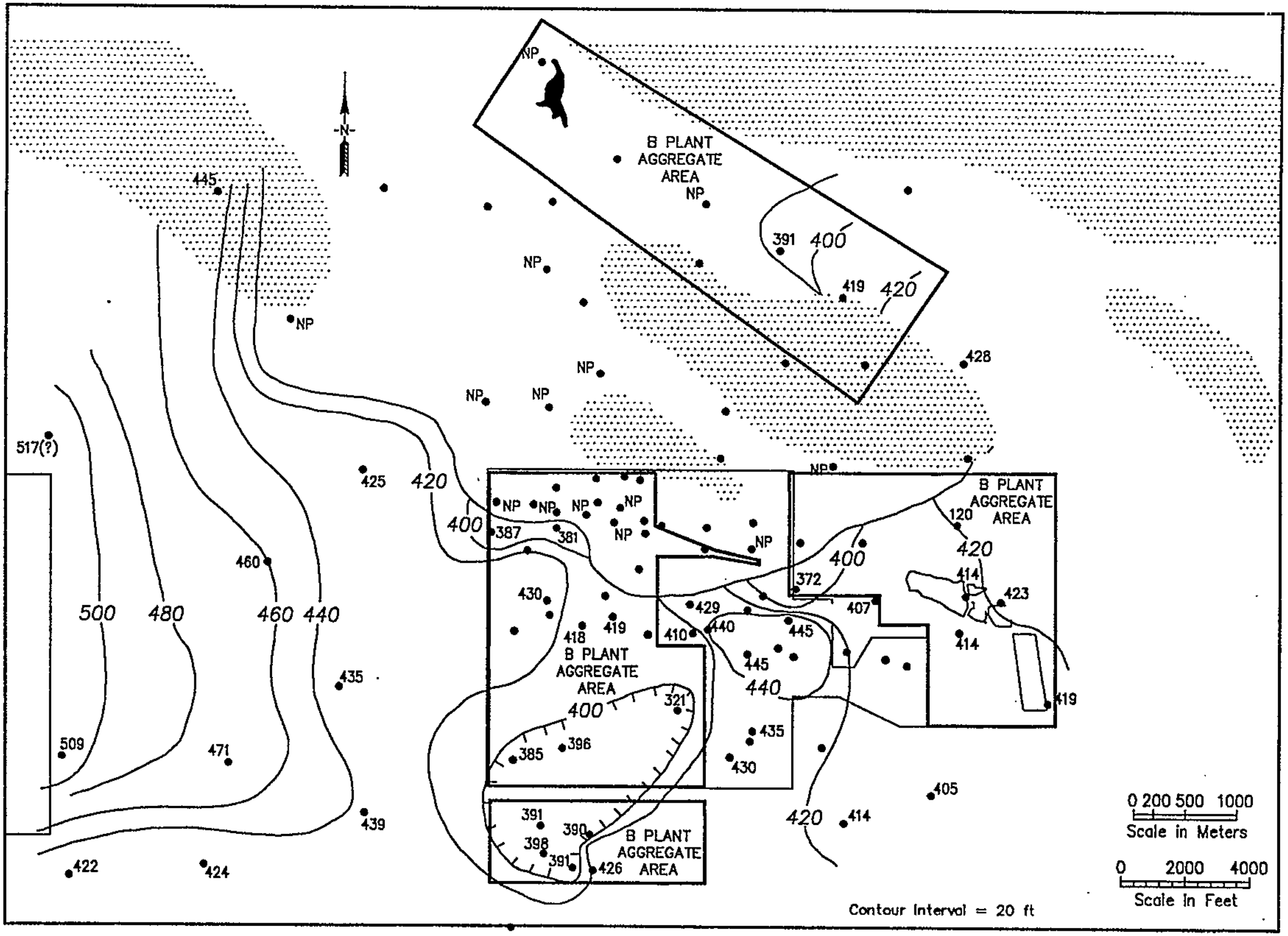

Figure 3-25. Structure Map of the Top of the Ringold Formation.

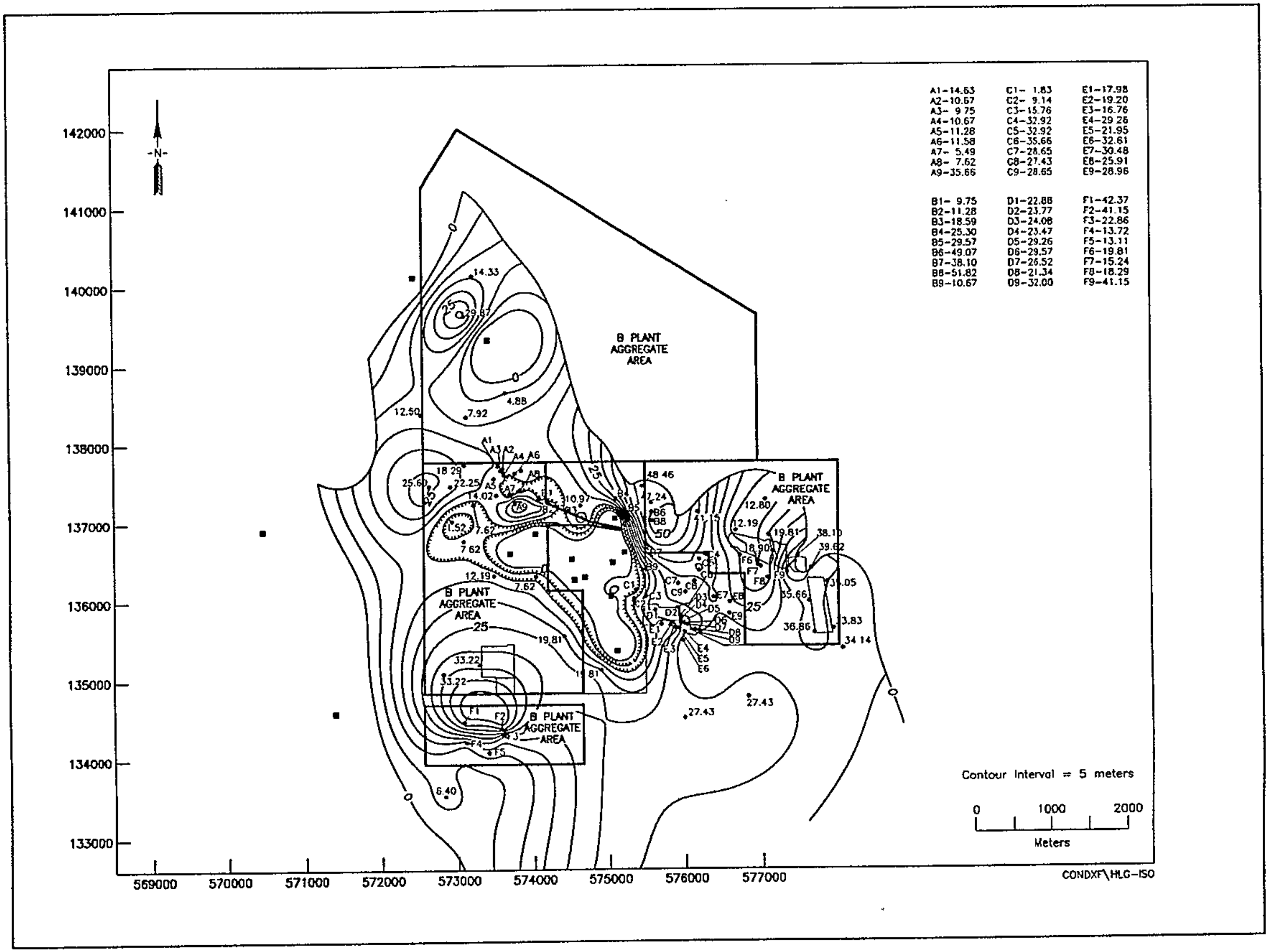

Figure 3-26. Isopach Map of the Lower Gravel Sequence, Hanford Formation.

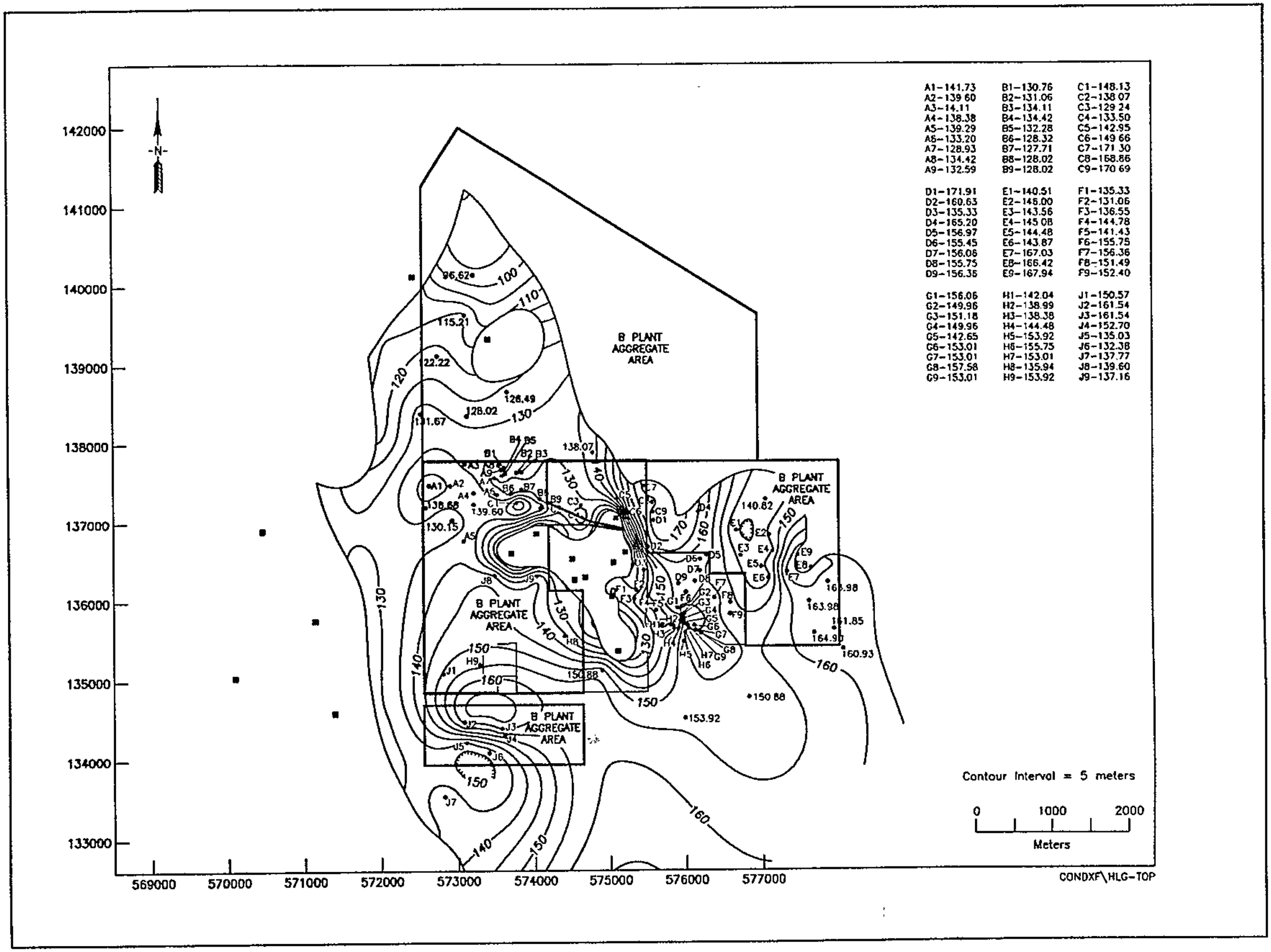

Figure 3-27. Structure Map of the Top of the Lower Gravel Sequence, Hanford Formation.

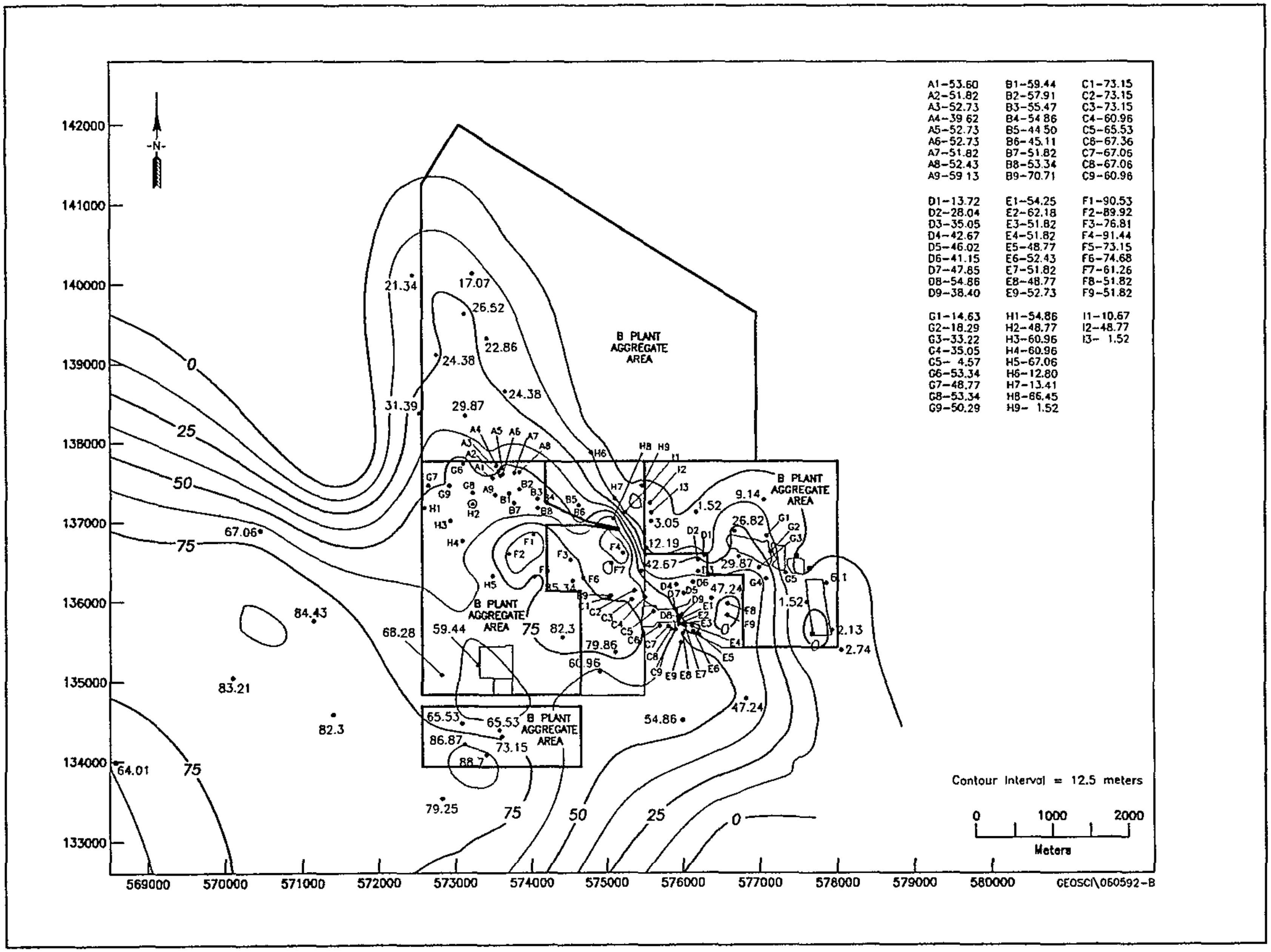

Figure 3-28. Isopach Map of the Sandy Sequence, Hanford Formation.

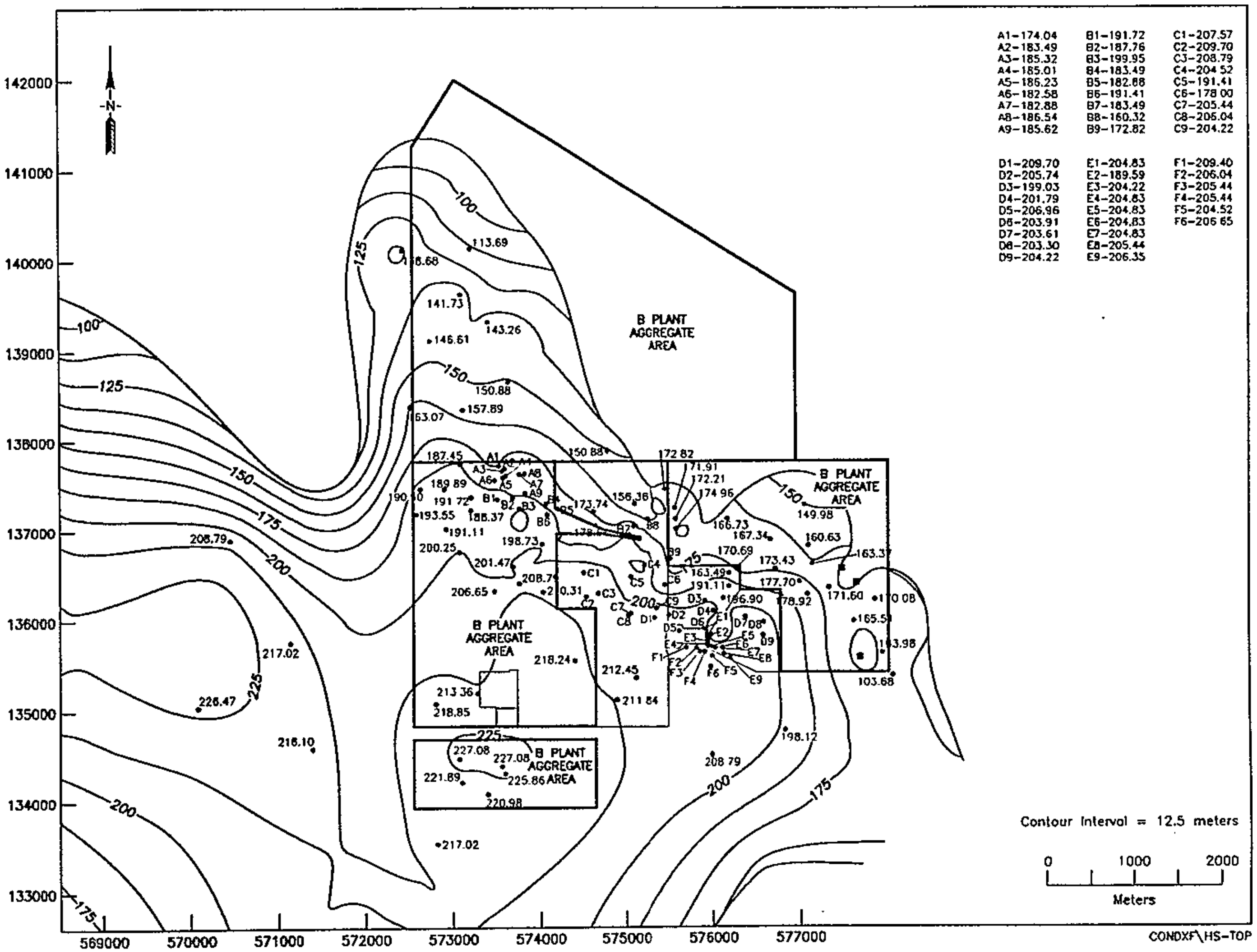

Figure 3-29. Structure Map of the Top of the Sandy Sequence, Hanford Formation.

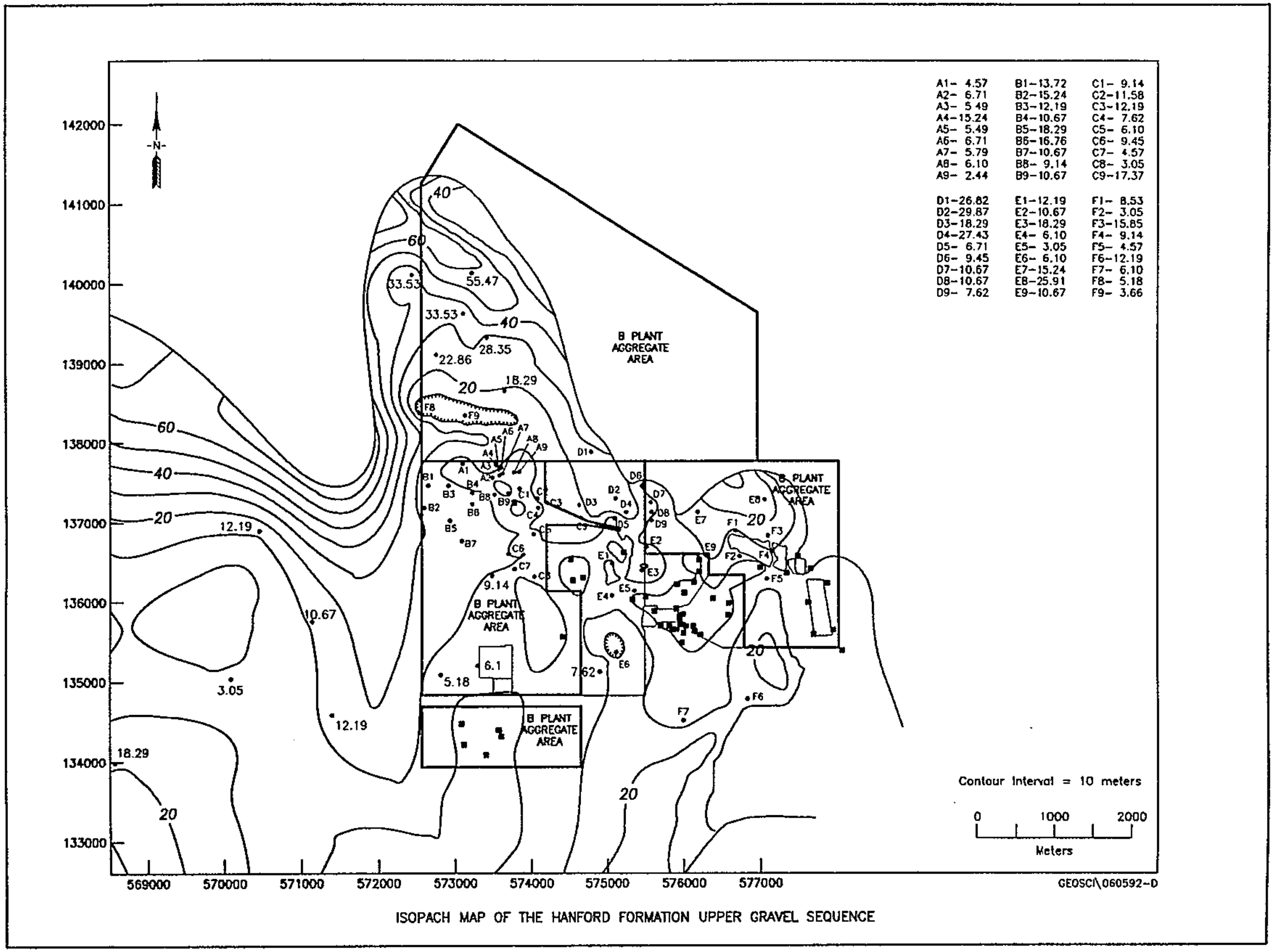

Figure 3-30. Isopach Map of the Upper Coarse Gravel Sequence, Hanford Formation.

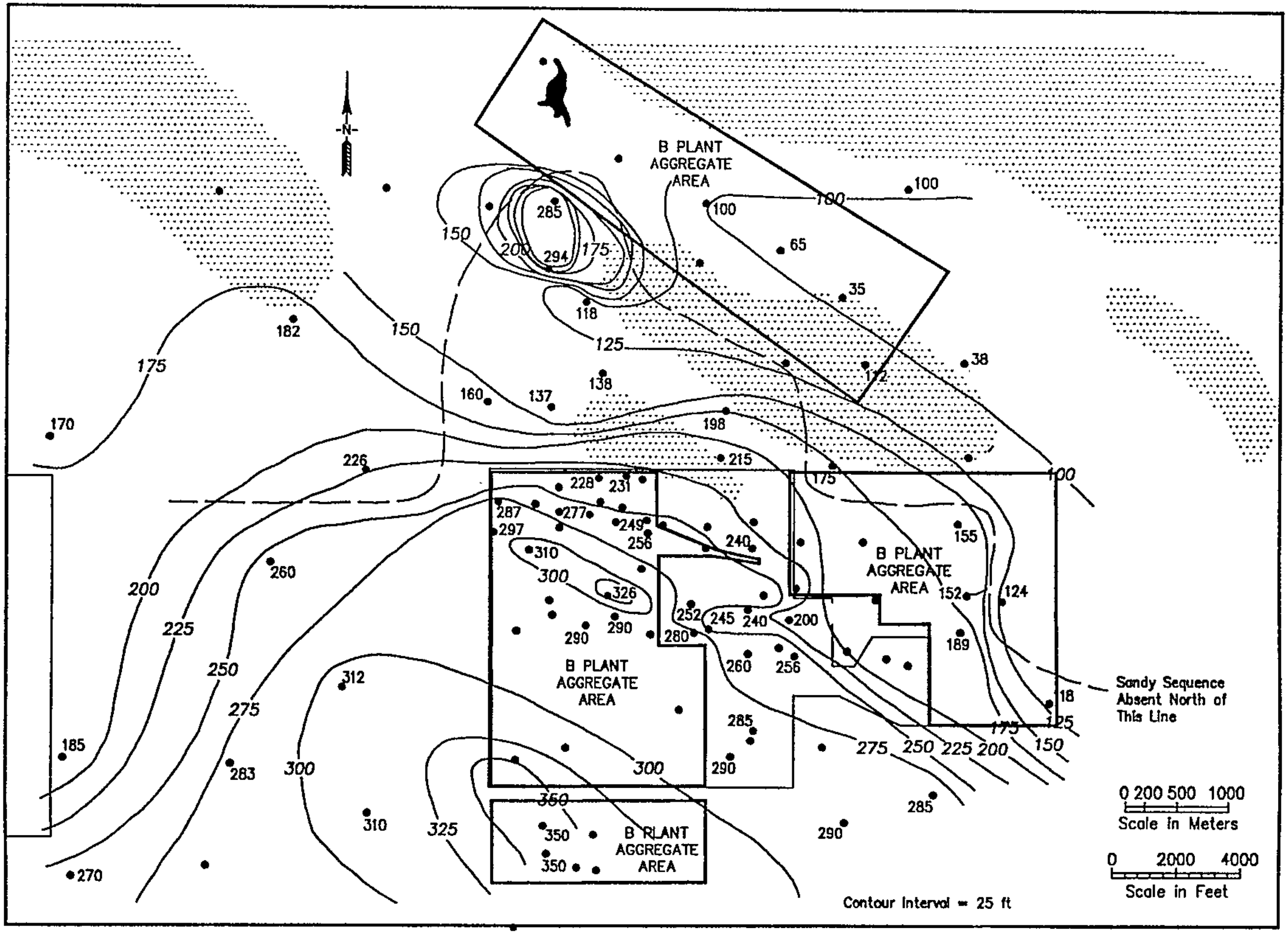

Figure 3-31. Isopach Map of the Entire Hanford Formation.

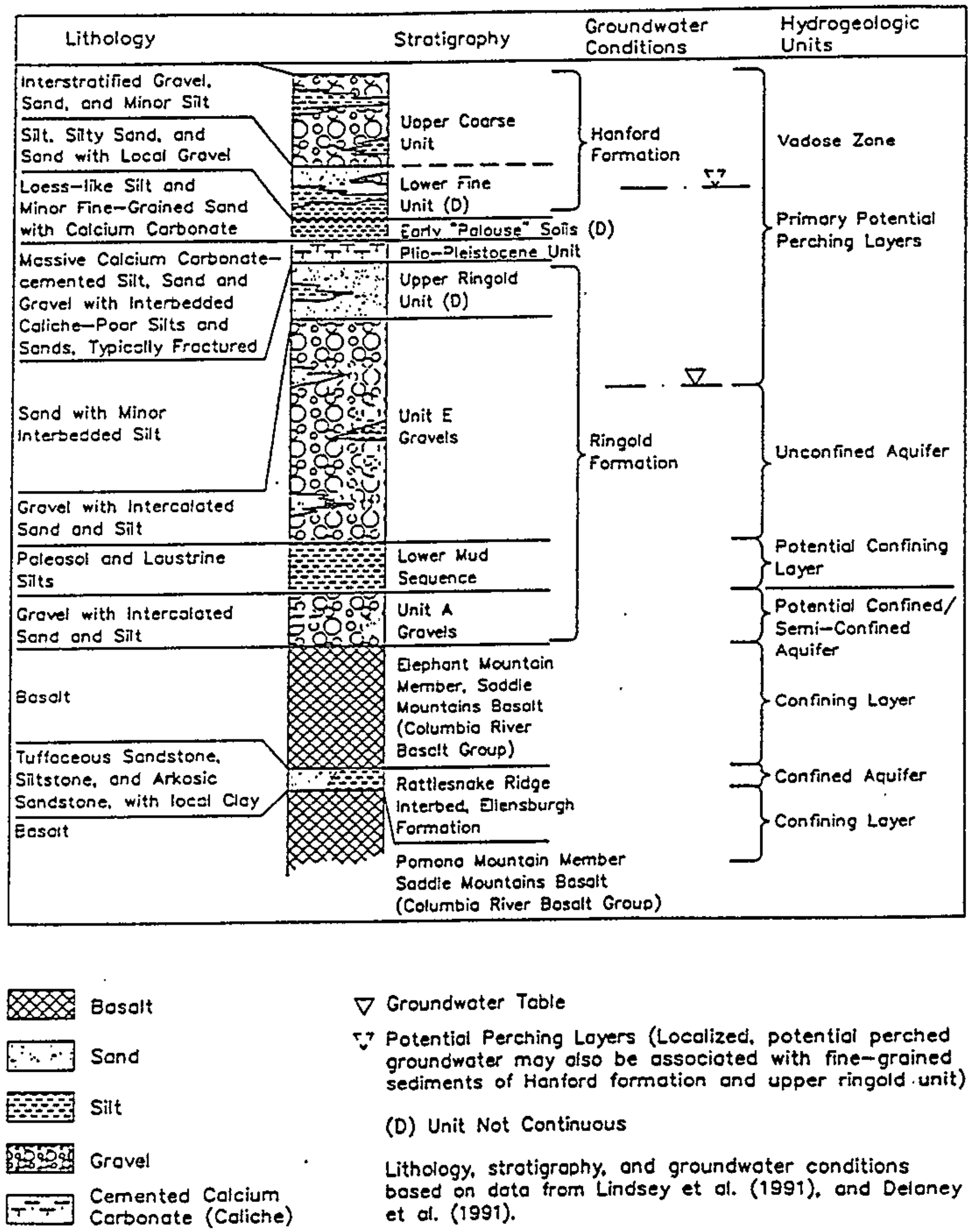

Figure 3-32. Conceptual Geologic Hydrocolumn for the Hanford Site.

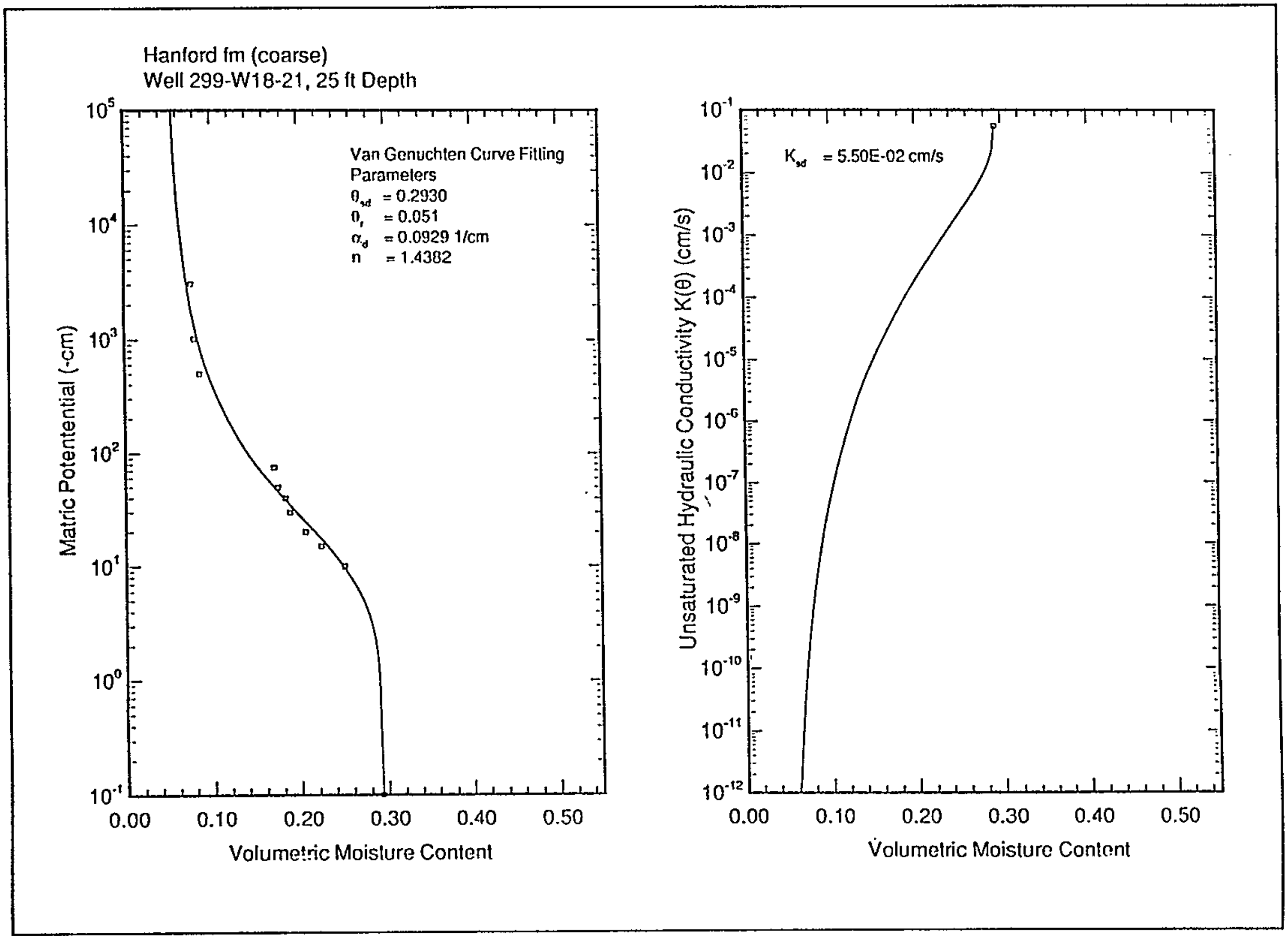

Figure 3-33. Wetting and Drying Curves for Well 299-W18-21.

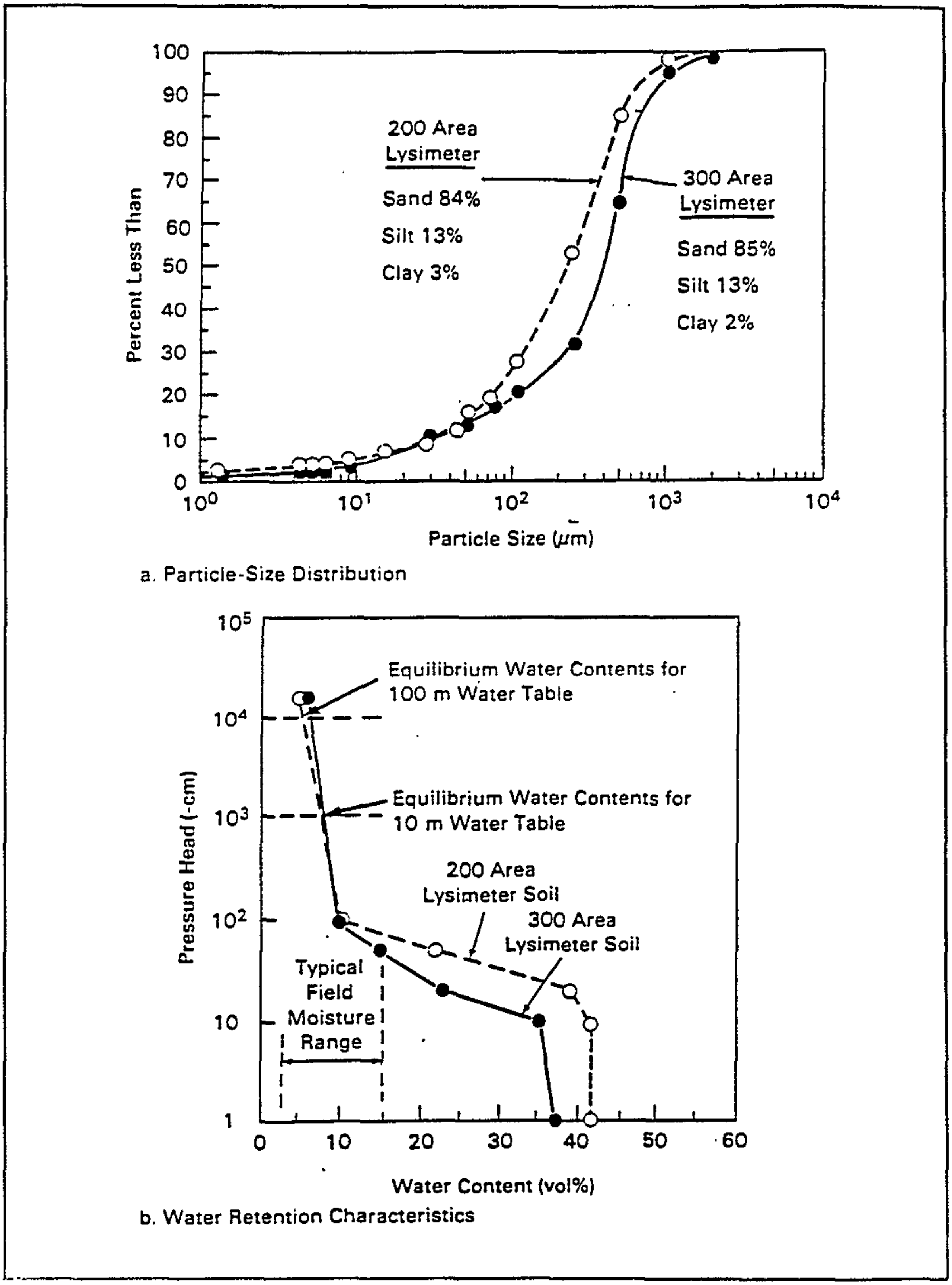

Figure 3-34. Particle Size Distribution and Water Retention Characteristics of Soils From Hanford Site Lysimeters.

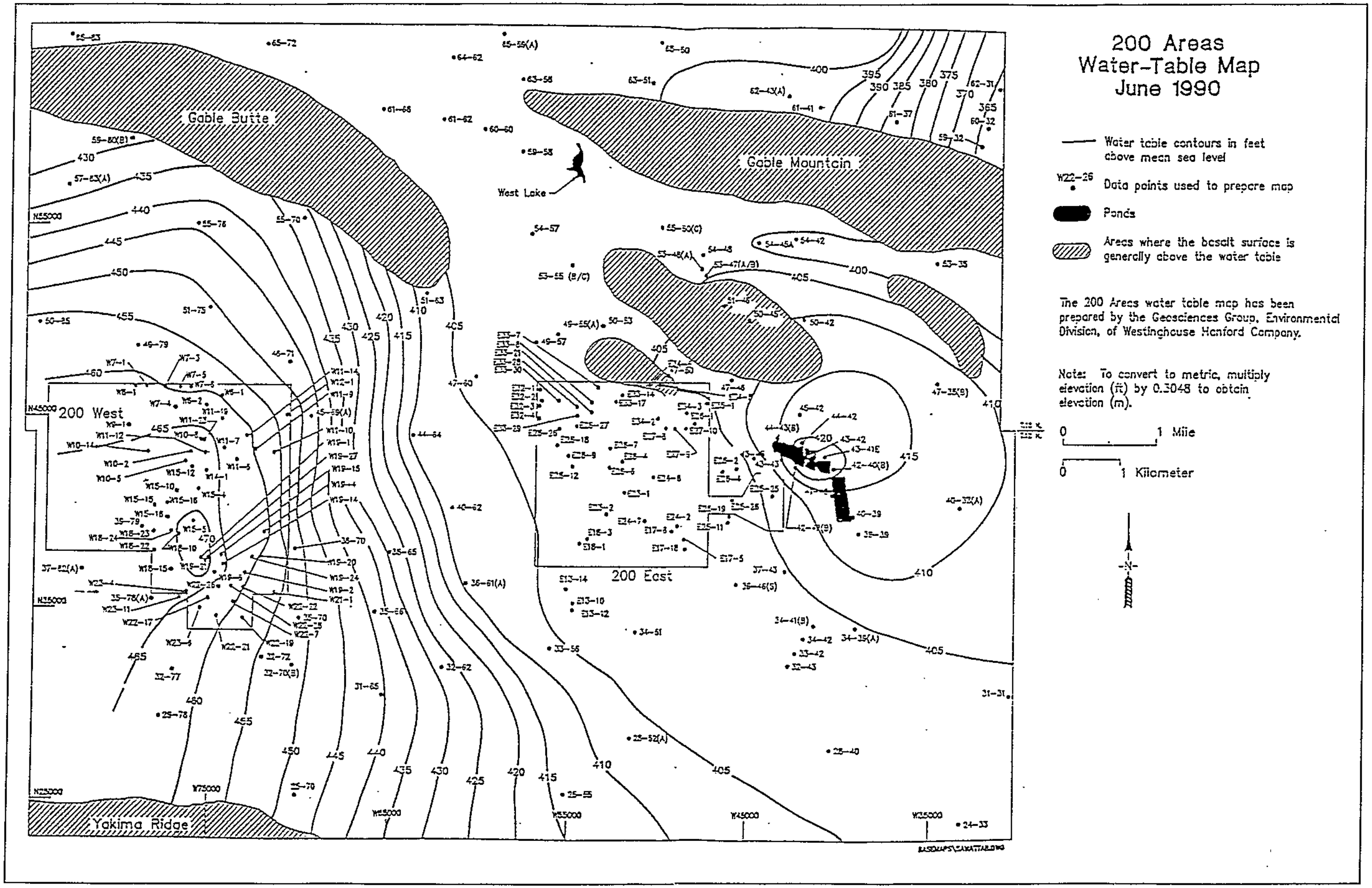

Figure 3-35. 200 Areas Water Table Map, June 1990. (Kasza et al. 1990)

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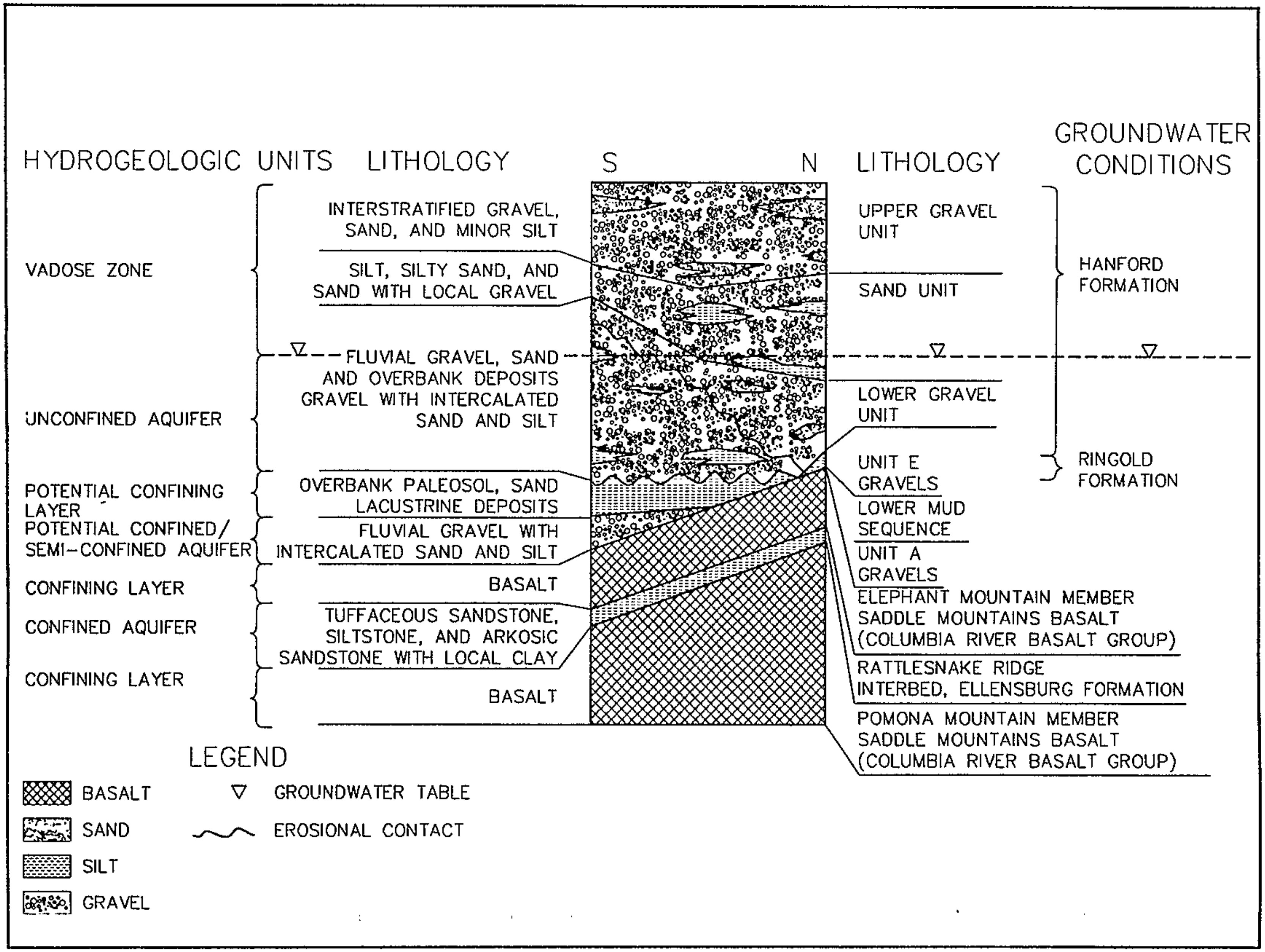

Figure 3-36. Conceptual Hydrogeologic Column for the B Plant Aggregate Area. (Lindsey et al. 1992; Delaney et. al 1991)

Table 3-1. Hydraulic Parameters for Various Areas and Geologic Units at the Hanford Site.

Location	Interval Tested	Hydraulic Conductivity (ft/d)	Transmissivity (ft^2/d)	Effective Porosity
Pasco Basin	Hanford Formation	500 - 20,300	--	--
	Ringold Formation Unit E	20 - 600	--	--
	Ringold Formation Unit A	0.1 - 10	--	--
100 Area	Ringold Formation Unit E	29 - 1,297	5,750 - 26,700	--
200 Areas	Hanford Formation	2,000 - 10,000	--	--
	Ringold Formation Unit E	9 - 230	--	--
	Ringold Formation Unit A	1 - 12	--	--
200 West Area	Ringold Formation Unit E	0.06 - 200	--	--
	Ringold Formation Unit A	1.7 - 4	--	--
	Lower Ringold laboratory	3×10^{-5} - 8×10^{-5}	--	--
Slug Tests at U-12 Crib	Upper Ringold	8 - 44	--	--
300 Area	Hanford Formation	11,000 - 50,000	--	--
300 Area	Ringold Formation	1.9 - 10,000	--	--
1100 Area	Ringold Formation Units C/B	3×10^{-1} - 5	--	--
1100 Area	Ringold Formation Overbank Deposits	8×10^{-4} - 1×10^{-1}	-- --	-- --

Table 3-2. Summary of Reported Hydraulic Conductivity Values for Hanford Site Vadose Zone Sediments. Page 1 of 2

Reported Hydraulic Conductivity Value or Range of Values in cm/s	Water Content Volume Percent	Reported Geologic Unit or Sediment Type	Test Area or Sampling Location	Measurement Method or Basis for Reported Value
6.7×10^{-7}	10	Sand	200 Area	Lysimeter Soil Experiments
1.7×10^{-8}	7	--	--	--
1.7×10^{-9}	5.5	--	--	--
1.7×10^{-10}	5	--	--	--
1.3×10^{-11}	4.3	--	--	--
2.6×10^{-3}	31	Sandy soil reported as "typical or many surface materials at the Hanford Site."	--	Unsaturated column studies.
5.7×10^{-4} (sat)	56		--	
6.3×10^{-11}	2.9	Near-surface soils	2-km south of 200 East Area	K estimates by Gee 1987 using water retention curve data from Figure 7 in Hsieh, et al., 1973.
2.2×10^{-11}	2.8	--		
5.40×10^{-8}	8.3	Sandy fill excavated from near-surface soil (Hanford formation) with 1.27-cm particle size fraction screened out.	Buried Waste Test Facility (BWTF): 300 North Area Burial Grounds	Laboratory steady-state flux measurements.
9.78×10^{-3} (sat)	42.2			
8.4×10^{-3} (sat, arithmetic mean of four measurements)	na			
8×10^{-8}	11	NA	BWTF: Southeast Caisson, and North Caisson	Unsteady drainage-flux field measurements.
4×10^{-3} (Southeast Caisson	26	NA		
1×10^{-8}	10	NA		
1×10^{-2} (North Caisson)	29	NA		
4.5×10^{-3} (arithmetic mean of 15 measurements)	Field Saturation	NA	BWTF North Caisson and area north of caisson	Guelph permeameter field measurements

Table 3-2. Summary of Reported Hydraulic Conductivity Values for Hanford Site Vadose Zone Sediments. Page 2 of 2

Reported Hydraulic Conductivity Value or Range of Values in cm/s	Water Content Volume Percent	Reported Geologic Unit or Sediment Type	Test Area or Sampling Location	Measurement Method or Basis for Reported Value
1×10^{-3} (Upper Soil, arithmetic mean of 7 measurements)	Field Saturation	Loam sand over sand Eolian Surficial deposits	Grass Site; 3 km of BWTF	Guelph permeameter field measurements
9.2×10^{-3} (Lower Soil, arithmetic mean of 4 measurements)	Field Saturation	NA		
8×10^{-7}	16	Loam to sandy loam Hanford formation	McGee Ranch:NW of 200 West Area on State Rt. 240	Unsteady drainage-flux field measurements.
9×10^{-4}	40			
9×10^{-4} (arithmetic mean of 9 measurements	Field Saturation	NA	--	Guelph permeameter field measurements.
5×10^{-3} (sat)	50	Sand, Gravel	Sediment types are idealized to represent stratigraphic layers commonly encountered below 200 Areas liquid disposal sites.	K_{sat} values derived from idealized moisture content curves on Figure B-1.
1×10^{-3} (sat)	50	Coarse Sand		
5×10^{-4} (sat)	40	Fine Sand		
1×10^{-4} (sat)	40	Sand, Silt		
5×10^{-5} (sat)	40	Caliche		
1.2×10^{-5} (sat)	19.6 to 18.9	Hanford formation	Well 299-W7-9, 218-W-5 Burial Ground	van Genuchten equation fitted to moisture characteristic curves for Well 299-W7-9 soil samples
6.7×10^{-6} to 2.8×10^{-1} (sat)	37.6 to 41.4	Early "Palouse" Soils		
1.10×10^{-3} (sat)	18.3 to 21	Upper Ringold	--	
1.80×10^{-4} to 3.00×10^{-4} (sat)	24 to 25	Middle Ringold	--	

Notes:
NA - Not identified in source.
sat - Value for saturated soil.
field saturation - Equilibrium water content after several days of gravity drainage.

Table 3-3. Endangered, Threatened, and Sensitive Plant Species Reported On or Near the Hanford Site.

Scientific Name	Common Name	Family	Washington State Status
Rorippa columbiae[a/] Suksd. ex Howell	Persistantsepal Yellowcress	Brassicaceae	Endangered
Artemesia campestris L ssp. *borealis* (Pall.) Hall & Clem. var. *wormskioldii*[a/] (Bess.) Cronq.	Northern Wormwood	Asteraceae	Endangered
Astragalus columbianus[a/] Barneby	Columbia Milk Vetch	Fabaceae	Threatened
Lomatium tuberosum[a/] Hoover	Hoover's Desert-Parsley	Apiaceae	Threatened
Astragalus arrectus Gray	Palouse Milk Vetch	Fabaceae	Sensitive
Collinsia sparsiflora Fisch.&Mey. var *bruciae* (Jones) Newsom	Few-Flowered Collinsia	Scrophulariaceae	Sensitive
Cryptantha interrupta (Greene)Pays.	Bristly Cryptantha	Boraginaceae	Sensitive
Cryptantha leucophaea Dougl. Pays	Gray Cryptantha	Boraginaceae	Sensitive
Erigeron piperianus Cronq.	Piper's Daisy	Asteraceae	Sensitive
Carex densa L.H. Bailey	Dense Sedge	Cyperaceae	Sensitive
Cyperus rivularis Kunth	Shining Flatsedge	Cyperaceae	Sensitive
Limosella acaulis Ses.&Moc.	Southern Mudwort	Scrophulariaceae	Sensitive
Lindernia anagallidea (Michx.)Pennell	False-pimpernel	Scrophulariaceae	Sensitive
Nicotiana attenuata Torr.	Coyote Tobacco	Solanaceae	Sensitive
Oenothera pygmaea Dougl.	Dwarf Evening-Primrose	Onagraceae	Sensitive

[a/] Indicates candidates on the 1991 Federal Register, Notice of Review.

Table 3-4. Federal and State Classifications of Animals That Could Occur on the 200 Areas Plateau.

Name	Status Federal	State
Peregrine Falcon (Falco peregrinus)	FE	SE
Sandhill Crane (Grus canadensis)		SE
Bald Eagle (Haliaeetus leucocephalus)	FT	ST
Ferruginous Hawk (Buteo regalis)	FC2	ST
Swainson's Hawk (Buteo swainsoni)	FC2	SC
Golden Eagle (Aquila chrysaetos)		SC
Burrowing Owl (Athene cunicularia)		SC
Loggerhead Shrike (Lanius ludovicianus)		SC
Sage Sparrow (Amphispiza belli)		SC
Great Blue Heron (Casmerodius albus)		SM
Merlin (Falco columbarius)		SM
Prairie Falcon (Falco mexicanus)		SM
Striped Whipsnake (Masticophis taeniatus)		SC

FE - Federal Endangered
FT - Federal Threatened
FC2 - Federal Candidate
SE - State Endangered
ST - State Threatened
SC - State Candidate
SM - State Monitor
Source: WHC (1992)

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

Section 4.1 presents the chemical and radiological data that are available for each waste management unit. These data, along with physical descriptions of the waste management units (Section 2.0) and descriptions of the surrounding environment (Section 3.0) are evaluated in Section 4.2 and 5.0 in order to qualitatively assess the potential impacts of the contamination to human health and to the environment. The quality and sufficiency of the existing data are assessed in Section 8.0. This information is also used to identify applicable or relevant and appropriate requirements (ARARs) (Section 6.0). Contaminant information is assessed in Section 7.0 to provide a basis for selecting technologies which can be implemented at the waste management units and unplanned release sites.

Contaminants that are released into the environment at a waste management unit or unplanned release site may migrate from the point of release into other types of media. Types of data for the B Plant Aggregate Area waste management units are listed in Table 4-1. The potentially affected media in the B Plant Aggregate Area include surface soil, surface waste, vadose zone soil and perched groundwater, air, and biota. The media that are affected at a specific site will depend upon the quantities, chemical and physical properties of the material released, and the subsequent site history. The potentially affected media at each waste management unit or unplanned release site are listed in Table 4-2 for radionuclide contamination and Table 4-3 for chemical contamination. A summary of the gamma-ray logs is presented in Table 4-4.

4.1 KNOWN AND SUSPECTED CONTAMINATION

There are two major categories of chemical and radiological data available for the B Plant Aggregate Area: site-specific data that are applicable to individual waste management units and unplanned releases; and area-wide environmental data that are useful in characterizing regional contamination trends.

Some waste management units and unplanned releases have been the subject of chemical and radiological studies in the past; however, most of these studies were limited in scope and did not provide a comprehensive analysis of the character and distribution of the contamination at each site. The types of site-specific data that are available for some sites include inventory information, surface radiological contamination surveys, external radiation dose rate monitoring, soil and sediment sampling, biota sampling , borehole geophysics, and groundwater sampling (Tables 4-5 through 4-10).

Table 4-1 summarizes the types of site-specific data available for each of the waste management units. It should be emphasized that the table only summarizes what types of data are available; it does not indicate the sufficiency of the data, either in terms of quality or quantity. These concerns are addressed in Section 8.0. The site-specific information is presented for each waste management unit in Section 4.1.2.

Although groundwater issues are considered outside the scope of this study, some groundwater data have been included. Groundwater contaminant plumes that are known to have originated from specific waste management units are described because they offer insight into the distribution of contaminants within the vadose zone. A limited amount of groundwater data are presented separately for some of the sites in Section 4.1.2.

In addition to these site-specific data, there are area-wide data that are not directly applicable to any waste management unit within the B Plant Aggregate Area. The most important sources of this general environmental data are quarterly and annual environmental surveillance reports published by Westinghouse Hanford. There are also area-wide geophysical data available that include gravity, magnetic, magnetotelluric, seismic refraction, and seismic reflection surveys (DOE 1988b). However, these studies are not useful for characterizing the extent of chemical and radionuclide contamination and are not presented in Section 4.0. These data are discussed in more detail in Section 8.1.2.

The most recent environmental monitoring of the Hanford Site was conducted by the Pacific Northwest Laboratory (PNL) and Westinghouse Hanford. However, most of the data that are applicable to the B Plant Aggregate Area have been published by Westinghouse Hanford. The latest Quarterly Environmental Radiological Survey Summary Reports were reviewed during the current study, as well as the last six annually published environmental surveillance reports (Elder et al. 1986, 1987, 1988, 1989; Schmidt et al. 1990, 1991). The quarterly reports only contain surface radiological contamination survey results. The annual reports describe several different sampling and survey programs including surface soil sampling, external radiation measurements, biota sampling, air sampling, surface water sampling, groundwater sampling, and radiological surveys.

Air, soil, surface water, and biota samples were collected each year at the same locations within the 200 East Area. External radiation measurements were also taken annually at several locations. Until 1990 few of the sample locations were directly associated with any of the identified waste management units and most of this information is only useful in characterizing area-wide trends. In 1990, however, new sampling locations were established that are near areas of known surface contamination. Data from these new sample locations has been included in the B Plant Aggregate Area Management Study (AAMSR). Both the new and old sampling locations are shown in Plates 3, 6, and 7.

Section 4.1 describes available data regarding known and suspected contamination in the B Plant Aggregate Area on a media-specific basis (air, surface soil, surface water, biota, and vadose zone soil). The text summarizes sources of chemical and radiological sampling information. Section 4.1.1 presents data on a media-specific basis. Section 4.1.1.1 presents results of air quality sampling data. Surface soil data are described in Section 4.1.1.2. Results of surface water sampling are presented in Section 4.1.1.3. Results of vegetation and other biota sample analyses are presented in Section 4.1.1.4. Available vadose zone sampling data are presented in Section 4.1.1.5. Section 4.1.1.5 also discusses evidence of contamination migration within the vadose zone to the unconfined aquifer underlying the site. Additional assessment of the nature and extent of groundwater contamination is presented in the 200 East Groundwater Aggregate AAMSR.

To supplement available radiological and chemical analytical data, historical waste inventory information for the B Plant Aggregate Area waste management units was also included in the evaluation of known and suspected contaminants. Historical waste inventory data are detailed in Section 2.0 of this report (Tables 2-3 and 2-4). As discussed in Section 2.0, the compilation is based on supporting data from the Waste Inventory Data System (WIDS) (WHC 1991a) and the Hanford Inactive Site Survey (HISS) Database (DOE 1986).

4.1.1 Affected Media

4.1.1.1 Air. Eight high volume samplers are stationed within or adjacent to the B Plant Aggregate Area (Plate 3). The samplers contain filters that collect airborne particulates.

The air samples are collected by drawing air at a flowrate of 2 ft^3/min through an open face filter positioned about 1 m (3 ft) above the ground. The filter used is 47 mm in diameter with a 3 μm rating. Throughout the 200 Areas air samplers are operated on a continuous basis. Sample filters are exchanged weekly, held one week to allow for decay of short-lived natural radioactivity, and sent for initial laboratory analyses of gross alpha and beta activity. After the initial analysis, the filters are stored until the end of the calendar quarter, at which time they are composited by sample location (or as deemed appropriate according to data need) and sent for laboratory analyses of specific radionuclides. Compositing of the filters by sample location provides a larger sample size, and thus, a more sensitive measurement of the concentration of airborne radionuclides resulting from operations in the 200 Areas.

The filters are analyzed quarterly for ^{90}Sr, ^{137}Cs, ^{239}Pu, and total U. The results have shown a steady decline in the concentration of these radionuclides from 1985 to 1987, a slight increase in 1988, and then a decline again in 1989 throughout the 200 East Area (Schmidt et al. 1990). The increased radionuclide concentrations in 1988 were on the average greater than 1987 concentrations; however, they were still lower than the first samples taken in 1985. The last five years of data for the B Plant Aggregate Area are summarized in Table 4-11. The complete data set since 1985 is summarized in Appendix A.2.

4.1.1.2 Surface Soil. There are several sources of data available for characterizing surface soil contamination. These include aerial and ground radiological surveys, external radiation measurements and surface soil sampling. These data will be presented in the following sections. In addition, there is a limited amount of site-specific radiological and soil sampling data that will be presented in the appropriate sections of Section 4.1.2.

4.1.1.2.1 Radiological Surveys. Radiological contamination survey results may be influenced by buried or airborne radionuclide contamination but are generally indicative of surface and shallow soil contamination. An aerial gamma-ray radiation survey was performed over the 200 East Area in July and August of 1988. The survey lines were flown with a 122 m (400 ft) spacing at an altitude of 61 m (200 ft). The data were normalized to a height of 1 m (3 ft) above the ground surface. Figure 4-1 presents the gross count data (ct/s) on an isoradiation contour map that covers the entire 200 East Area.

The entire area has gross gamma counts that are above background. The highest gross count results in the B Plant Aggregate Area were between 700,000 and 2,200,000 ct/s measured over the 241-BX and 241-BY Tank Farm areas (site number 6 on Figure 4-1). This high count area has lobes that extend south and southeastward into the 241-B Tank Farm (site number 7 on Figure 4-1). This is where concentrated high-level waste is stored in 40 underground single-shell tanks and is a known area of significant surface contamination. The second highest area with counts between 220,000 and 700,000 ct/s is located around and immediately southeast of the 221-B Building (site number 9 on Figure 4-1). Waste management units 216-B-4 Reverse Well, 216-B-6 Reverse Well, 216-B-13 French Drain, and Unplanned Releases UN-200-E-44, UN-200E-90, and UN-200-E-103 are clustered in this vicinity. The third highest area with counts between 70,000 and 220,000 ct/s is located at the 225-B Building and west of the 221-B Building (site number 8 in Figure 4-1). Waste management units 216-B-55 Crib, 216-B-64 Retention Basin, and Unplanned Release UN-200-E-64 are located in this area.

These latter two sites are actually a combination of contained, controlled radiation and surface and sub-surface contamination which can not be differentiated. These sites contain: (1) the Waste Encapsulation and Storage Facility (WESF) pool and (2) the high efficiency particulate air (HEPA) filters in the B Plant hot cells. These two sites contain tremendous radiological inventories which undoubtedly influenced the survey and accentuated the reported count values. This fact should be kept in mind when considering Figure 4-1.

It is nearly impossible to convert these gross gamma counts to a meaningful exposure rate because of the complex distribution of radionuclides on the site. Spectra logs were generated for five sites within the B Plant Aggregate Area and these had only one identifiable photopeak. Cesium-137 was the only radionuclide that could be identified from the spectra information that was collected over each of the five sites during the 1988 survey. As such, the aerial radiation survey data should only be used as a qualitative tool for identifying more highly contaminated areas within the survey boundaries. In addition, the gamma counts noted in the survey probably result from both surface and shallow buried radionuclides, and are, thus, not entirely indicative of surface contamination.

Elevated radiation zones identified by the aerial survey generally correspond to areas where surface contamination has been noted by surface radiation surveys. Figure 4-2 shows areas of known surface contamination, underground contamination, and migration identified from surface surveys. The primary areas of surface contamination noted in the B Plant Aggregate Area include:

- the 241-BY Tank Farm
- the 241-BX Tank Farm
- the 241-B Tank Farm
- the UPR-200-E-95 Unplanned Release associated with the railroad flatcar storage of contaminated material near the 218-E-2A and 218-E-5 Burial Grounds
- the 207-B Retention Basin
- the 216-B-59B Retention Basin
- the 216-B-5 Reverse Well
- the 241-B-154 Diversion Box
- the miscellaneous area along the railroad spur entering the east end of the 221-B Building
- the 216-B-64 Retention Basin
- the 216-B-55 Crib
- the 218-E-10 Burial Ground

- the 241-ER-151 Diversion Box

- the 216-B-3 Pond.

Most of these areas fall within the high zones noted in the radiation survey. Areas of active surface contaminant migration include:

- areas north and east of the 241-B Tank Farm

- west and southwest of the 216-B-64 Retention Basin

- a small patch north of the 241-B-154 Diversion Box

- west of the 241-ER-151 Diversion Box

- the east end of the cross-country transfer line (at the connection to the 241-ER-151 Diversion Box)

- a 10.4 km^2 (4 mi^2) area east, south, and west of the 200-BP-2 Operable Unit (BC Controlled Area).

Table 4-7 summarizes the radiological survey results for each waste management unit and unplanned release. The areas of surface contamination and contaminant migration will be discussed in more detail in the section dealing with the individual waste management units and unplanned releases (Section 4.1.2). Surface radiological surveys are done quarterly, semiannually, or annually at the waste management units. The surface contamination posting may change often because of resurveying and because of cleanups affected under the Radiation Reduction Program.

4.1.1.2.2 External Radiation Dose Rate Measurements. Dose rates from penetrating radiation were measured annually at 24 grid locations directly within or adjacent to the B Plant Aggregate Area between 1985 and 1989. The sample locations are shown on Plates 3, 6, and 7 and the results are listed in Table 4-5 and Table 4-6. The measurements were taken with thermoluminescent dosimeters (TLDs) and are reported in mrem/yr. The TLDs measure dose rates resulting from all types of external penetrating radiation sources including cosmic radiation, naturally occurring radioactivity, fallout from nuclear weapons testing, and contributions from other Hanford Site activities. The B Plant Aggregate Area external radiation dose rate measurements have been remarkably consistent ranging from 68 to 140 mrem/yr and averaging 105 mrem/yr over all sites for 1989. There appears to be an increasing trend in dose rates from 1985 to 1988, however, this can be attributed to variability in naturally occurring dose rates and statistical uncertainty in conducting dose rate measurements (PNL 1989). Above average sites include the 241-BX Tank Farm at 126 mrem/yr and an area near the 221-B Building at 113 mrem/yr. Generally, the tank farm areas, the 216-B-55 Crib, and the 216-B-3-3 and 216-B-63 Ditches run above average.

In 1990, new sampling locations were established giving B Plant Aggregate Area a reduction to 16 dosimeter sites. The new sites were generally located closer to areas of known contamination with the results being similar to previous data. The results are summarized in Table 4-6.

4.1.1.2.3 Surface Soil Sampling. Between 1978 and 1989 surface soil samples were collected annually from a regular grid that covers the 200 East Area with 36 sampling points. Nine of these sampling sites are located in or adjacent to the B Plant Aggregate Area. The sample point locations have never been exactly surveyed, but are located close to the intersections of Hanford Site coordinate lines at 610 m (1,000 ft) spacings. An effort is currently underway to assign precise coordinates to the sample point locations using a new surveying method. In addition, between 1984 and 1989, soils have been sampled along fences enclosing the tank farms in the 200 East Area. There are two soil sample locations associated with the 241-B Tank Farm and one soil sample associated with the 241-BX Tank Farm. None of the soil sampling locations were at waste management units or unplanned release sites, so these data cannot be applied directly.

The results of the soil sampling programs since 1985 are summarized in Tables 4-8 and 4-9. Tables that present all of the data collected since 1985 are contained in Appendix A.2. Counting errors are included with each analytical result and those that are greater than the accompanying counting errors are denoted with shading.

The most commonly detected radionuclides were ^{90}Sr, ^{137}Cs, ^{214}Pb, U total, ^{238}Pu, ^{239}Pu, and ^{152}Eu. However, only ^{137}Cs, ^{90}Sr, ^{214}Pb, U total, and ^{239}Pu were found consistently at concentrations above counting errors (Schmidt et al. 1990)

The highest radionuclide concentrations were generally noted in the vicinity of the 241-B, 241-BX, and 241-BY Tank Farms. Using ^{137}Cs as an indicator of general radionuclide concentration, the highest levels most recently recorded were at grid points 2E3 and 2E9, north and south of the tank farm area. However, the trend at these locations has generally been downward since 1978. The highest ^{90}Sr concentration was found south of the tank farm and the highest ^{239}Pu concentration was found west of the burial grounds.

In 1990, new soil sampling locations were established that are located close to areas of known surface contamination. The locations of these new sites are shown on Plate 3. There are new sample locations within or adjacent to the B Plant Aggregate Area. Currently, no analytical data are available for these new sample locations.

4.1.1.3 Surface Water. Surface water exists in the B Plant Aggregate Area in waste management units 216-N-8 Pond (West Lake), 216-B-63 Ditch, 216-B-3-3 Ditch, and the 216-B-3 Pond and its lobes. The Gable Mountain Pond, 216-A-25, which had been part of the surface water sampling system, has been decommissioned. Water samples of 1 L (0.26 gal) are collected on a weekly basis from active ponds and ditches and analyzed for pH, nitrate, total alpha, total beta, gamma-emitting radionuclides, ^{137}Cs, and ^{90}Sr. In addition to surface water sampling, all water is also sampled at its point of discharge.

Analysis results are presented in Table 4-12, in the form of minimum and maximum measured levels. Surface water sources include 221-B Building and 202-A Building cooling water discharge, the 200 East Powerhouse process water discharge, the chemical sewers from both the 221-B and 202-A Buildings, process waste from the 242-A Evaporator, and groundwater seepage. Maximum levels are well below allowable limits in all cases with the minimum levels usually below the detectable limit. The only result of note is the somewhat high pH for 216-N-8 Pond (West Lake). No waste is actually discharged to this unit but the water level is maintained by groundwater seepage. The pH level is attributed to the high level of phosphates in the soil.

4.1.1.4 Biota. Westinghouse Hanford and PNL have conducted various biota sampling activities inside and outside the Hanford Site beginning in 1971 and continuing through 1988. No upward trends in radionuclide concentrations were detected for any of the wildlife species examined. A significant downward trend was noted in many sample analytes, particularly ^{137}Cs.

Three factors are believed to have contributed to the decline in concentration of these radionuclides: the cessation of atmospheric testing, the 1971 shutdown of the last Hanford reactor that discharged once-through cooling water to the river, and the reduction of environmental radionuclide contamination associated with some Hanford facilities and operations.

Biota samples have been collected since 1978 from eighteen sites within or adjacent to the B Plant Aggregate Area. Vegetation samples were collected from the same locations as the grid soil samples described in Section 4.1.1.2 (Plate 3). Average analytical results from 1985 through 1989 are compiled in Table 4-10. The complete data set from this sampling is presented in Appendix A.2.

Vegetation samples have generally had radionuclide concentrations that are slightly elevated above regional background (Schmidt et al. 1990). The most commonly detected radionuclides include ^{40}K, ^{99}Te, ^{103}Ru, and ^{137}Cs. There have been no statistically significant trends in vegetation radionuclide concentration since 1979 (Schmidt et al. 1990).

4.1.1.5 Vadose Zone. The extent of contamination in the vadose zone has been most extensively studied by geophysical borehole logging. Geophysical borehole logging has been conducted in the B Plant Aggregate Area since the late 1950's. Gross gamma-ray logs have been used since that time to evaluate radionuclide migration in the vadose zone beneath selected waste management units. However, very little gross gamma data have been published. Table 4-4 lists all of the logs that were reviewed as a part of this study. The log interpretation consisted of identifying zones with anomalously high gamma-ray counts that could be indicative of radionuclide contamination. The depth, thickness, and intensity of these zones were then compared with previous logs from these same holes. Any significant changes may be indicative of contaminant migration in the vadose zone. Interpretations were complicated by the fact that logging equipment and procedures have not been consistent. Attempts made to normalize data collected at different times met with limited success, and quantitative interpretations were not possible. The log interpretations are discussed in detail in Appendix A.1. The results of the log interpretations are also summarized with the appropriate waste management units in Section 4.1.2.

Waste management units that have received large volumes of liquid are more likely to cause subsurface contaminant migration. The potential for liquid wastes to migrate through the vadose zone to the groundwater can be conservatively estimated by comparing the volume of waste discharged at each waste management unit to the estimated pore volume in the vadose zone soil column below the waste management unit. If the volume of liquid discharged to the ground is larger than the total soil column pore volume, then it is likely that wastewater would reach the groundwater. These calculations are summarized in Table 4-14. They are based upon several conservative assumptions: (1) the discharged water does not spread out laterally from the point of discharge (i.e., the volume of affected vadose zone is equal to the depth to groundwater times the plan-view area of the base of the waste management unit); (2) there is no significant change in liquid volume being introduced to the soil column due to evapotranspiration or precipitation; and (3) the average pore volume of the soil column is between 0.1 and 0.3 (the lower and upper pore volume estimates shown in Table 4-14). According to these calculations 48 waste management units have the potential for migration of liquid discharges to the unconfined aquifer. This count is based on the lower pore volume estimate (i.e., 0.1).

4.1.2 Site Specific Data

This section presents the site-specific data that are available for each waste management unit and unplanned release. The units are discussed in the same groups as were presented in Section 2.0. These groupings are useful because like units tend to have similar types of available data.

4.1.2.1 Plants, Buildings, and Storage Areas. No site-specific data were compiled for any of the B Plant Aggregate Area plants and buildings. However, there are four hazardous waste storage areas (HWSA) that are active waste management units. The four are very similar and will be discussed together.

All HWSA's provide temporary storage for hazardous chemicals, typically near the site where they are generated, until arrangements can be made for their removal to a TSD facility. Temporary storage time is strictly limited by RCRA provisions. All B Plant Aggregate Area HWSA's are inspected weekly by plant personnel and the inspections are documented.

Three HWSA's, 2703-E, 2704-E, and 2715-EA, are located in the 200-SS-1 Operable Unit. The first two are simple asphalt pads and the last is a metal shed. The fourth is 226-B, which is a concrete pad located in the 200-BP-6 Operable Unit. Common features include light chain barricades and hazardous material warning signs. Typical materials found in the storage areas are waste acids, alkaline liquids and sodium hydroxide solutions, sodium dichromate containing process solutions, antifreeze, grease, diesel fuel, waste paint and thinning solvents, halogenated hydrocarbons, and flammable solvents.

4.1.2.2 Tanks and Vaults. The data available for the single-shell waste storage tanks generally include inventory information, limited waste sampling, surface radiological surveys, vadose zone borehole geophysics, and internal tank monitoring of chemical and physical parameters. In the past there has been much less emphasis in characterizing the catch tanks, settling tanks, and vaults and little information is available regarding these units. The following section is subdivided between single-shell tanks and other tanks to reflect this difference.

4.1.2.2.1 Single-Shell Tanks. All of the single-shell tanks in the B Plant Aggregate Area are located within the boundaries of the three contiguous tank farms: 241-B Tank Farm, 241-BX Tank Farm, and 241-BY Tank Farm. All the tank farms are characterized as areas of surface contamination and there are areas of active surface migration both north and east of the tank farm's boundaries (Schmidt and Huckfeldt 1991).

The TLDs stationed around the three tank farms have averaged 100 to 140 mrem/yr between 1985 and 1989 (Table 4-5). A single monitoring station located south of the 241-BX Tank Farm in 1990 averaged 138 mrem/yr (Table 4-6). These results are slightly higher than other monitoring stations located in the B Plant Aggregate Area. The high annual dose rate is probably indicative of a combination of surface contamination in the tank farm areas and some emissions from the tanks themselves. Future sampling and analysis plans, which will be developed as a part of the investigation of these areas, will attempt to define and quantify the dose rate contributors. The upper surfaces of tanks 241-B-101 through 241-B-

112 and 241-BX-101 through 241-BX-112 are all 2 m (7 ft) below grade, tanks 241-BY-101 through 241-BY-112 are all 2 m (8 ft) below grade, and tanks 241-B-201 through 241-B-204 are all 4 m (11 ft) below grade, so the waste contained within the tanks is largely, but not entirely shielded from the ground surface.

External radiation dose rate surveys are performed quarterly over the three tank farm areas. The highest dose rates observed for the last half of 1991 occurred in the 241-BY Tank Farm. Dose rates here are generally three to ten times higher than those measured in either the 241-B or 241-BX Tank Farms. The dose rates for the 241-B and 241-BX Tank Farms are similar.

The highest dose rate noted was around the pump pit riser for tank 241-BY-105. The greatest surface contamination noted over the last half of 1991 was the northern portion of the 241-BY Tank Farm. In the 241-B Tank Farm, tanks B-101 and B-102 had the highest external dose rates, while in the 241-BX Tank Farm, tanks BX-109, BX-110, and BX-111 were the areas of highest external dose rate. These data were compiled directly from the Supplemental Scheduled Radiation Survey Reports kept at the Tank Farm Health Physics Department for the 200 East Area (building MO-386).

Several studies have been conducted to estimate the tank contents and the probability of their release to the environment. The primary potential release mechanisms are tank failure and leaking, and the potential buildup and ignition of flammable material in the tanks. Ten of the sixteen tanks in the 241-B Tank Farm, five of the twelve tanks in the 241-BX Tank Farm, and five of the twelve tanks in the 241-BY Tank Farm have failed in the past, so it seems likely that some of the remaining tanks may fail in the future. Tank leaks are identified by monitoring liquid levels in the tanks and by running gamma logs in the monitoring boreholes surrounding each tank.

Inventory Studies. Chemical inventories for the single-shell tanks have been modeled with the Tracks Radioactive Components (TRAC) computer code developed by Westinghouse Hanford. This program calculated tank inventories for 68 radioactive constituents and 30 chemical constituents. The estimates were based on historical records of the quantities of material initially placed in the tanks from nuclear fuel production and later modified by tank transfers and radioactive decay. The TRAC inventories, though recognized as having serious limitations, represent the best current information on the contents of the tanks. The TRAC predictions for ^{14}C, ^{137}Cs, ^{137}Ba and uranium isotopes show the least agreement with other data sources.

The TRAC inventory data are presented in Table 4-15. These data are for the total tank inventories and do not differentiate between drainable liquid and solids within the tanks. As shown in Table 2-2, some of the unstabilized tanks still contain large volumes of liquid, drainable waste. It is the radionuclides that are partitioned to this liquid phase, which are of primary concern should a tank begin to leak. From a comparison of solid and liquid phase data presented in an earlier TRAC report, it appears that ^{241}Am, ^{14}C, ^{135}Cs, ^{137}Cs, ^{93}Nb, ^{99}Tc, ^{79}Se, and ^{90}Sr are most strongly partitioned to the liquid phase in the tanks and would be the most likely radionuclides, present at high concentrations, to migrate in the event of a leak (Jungfleisch 1984).

Tank Waste Sampling. Chemical sampling and analysis has been performed on some tank contents. The usefulness of these data are limited because: (1) very few radionuclides or organic chemicals were analyzed, (2) much of the sampling and analysis was done in the 1970's and material has been moved into and out of the tanks since that time, (3) the approach was noncomprehensive resulting in data gaps and inconsistencies. Much of the sampling and analysis was done on an ad hoc basis to answer specific questions.

Selected available chemical data for several tanks are summarized in Table 4-13. The information in the table was compiled from technical letters in the Process Aids volumes in the MO-037 Library. The table includes sample descriptions, radionuclide data for each sample, and bulk density results.

Chemical Explosion Potential. The two most significant explosive materials generated in Hanford single-shell tanks are ferrocyanide and hydrogen. None of the B Plant Aggregate Area tank farm tanks is suspected of having a hydrogen problem; however, several have the potential to generate significant quantities of ferrocyanide (Hanlon 1991). A watch list has been generated that ranks tanks according to their potential for explosion. The factors in this ranking include surface level fluctuation, temperature, total curies of waste, organic content, volume of solids, waste type, pressurization, crust formation, and past flammable gas detections. A total of four tanks from the 241-BX Tank Farm (241-BX-102, 241-BX-106, 241-BX-110, and 241-BX-111) and ten tanks from the 241-BY Tank Farm (241-BY-101, 241-BY-103, 241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-110, 241-BY-111, and 241-BY-112) are on the ferrocyanide gas watch list. There are a total of 24 tanks on this watch list. Four of the B Plant Aggregate Area tanks have the highest estimated quantities of ferrocyanide while five tanks are among the lowest ranked for ferrocyanide.

Tank 241-B-103 is on the watch list for tanks containing concentrations of organic salts greater than 10 wt% total organic compounds (TOCs). These tanks have organic chemicals which are potentially flammable and mixtures of organic materials mixed with nitrate and nitrate salts can deflagrate. This tank is one of eight on the TOC watch list.

Vadose Zone Borehole Geophysical Logging. Most of the single-shell tanks are surrounded by an array of vadose zone boreholes. Gamma logging is performed on these boreholes to identify new tanks leaks and to monitor the migration of existing radioactive contaminant releases to the soil. Table 4-16 summarizes the borehole geophysical data available for each tank. Twelve of the twenty assumed or confirmed leaking tanks in the 241-B, 241-BX, and 241-BY Tank Farms exhibit elevated gamma radiation levels in their associated monitor boreholes.

Single-Shell Tanks Unplanned Releases. There are twelve unplanned releases associated with the single-shell tanks of the 241-B, 241-BX, and 241-BY Tank Farms. Nine of these unplanned releases resulted from tank leaks (UPR-200-E-127 through 135) and three occurred during liquid transfer operations (UPR-200-E-5, UPR-200-E-108, and UPR-200-E-116). Most of the available information on these releases is summarized in Table 2-6. Cesium inventory data for each of the tank leaks are summarized in Table 4-17. Radionuclide inventories for burial sites can be found in Table 4-18.

Activity noted by increases in borehole activity (Table 4-16) can usually be related to known, unplanned releases. Unplanned release UPR-200-E-108 occurred due to a leak in a transfer line when pumping from tank 241-B-102 to tank 241-B-101. This leak corresponds to activity in borehole 20-01-06 since radiation is noted to start at the top of the tank liner. Activity noted in boreholes around tanks 241-B-112 and 241-B-201 are likely related to leaks from tanks 241-B-201 (UPR-200-E-129) and 241-B-203 (UPR-200-E-130), which are nearby.

Activity in the vicinity of tanks 241-BX-102 and 241-BX-103 are directly related to three unplanned releases, UPR-200-E-5, -131, and -132. Releases UPR-200-E-131 and -132 are leaks from Tank 241-BX-102. An estimated 51,000 Ci seeped to a depth of 40 m (120 ft) from UPR-200-E-131. Some contamination may have spread to groundwater as a result of borehole drilling. A plugged cascade outlet (UPR-200-E-5) allowed 100,000 to 340,000 L (30,000 to 90,000 gal) of waste to contaminate the soil around 241-BX-102 in 1951.

A leak (UPR-200-E-133) from tank 241-BX-108 was noted in Borehole 20-08-06. This 500 Ci release occurred in March 1974. Borehole activity has since stabilized.

A leak (UPR-200-E-134) from tank 241-BY-103 was confirmed by borehole activity which spread from a 8 m (60 ft) depth down to a 23 m (77 ft) depth in March 1973.

4.1.2.2.2 Catch Tanks and Vaults. Very little data are available for the catch tanks and vaults. For some units the total volume of waste is known but there is no chemical or radiological information available.

241-B-301B Catch Tank. This is an inactive waste management unit. The volume of the contents of the tank are unknown and it is not monitored. The unit was isolated in 1985 and is weather covered.

241-B-302B Catch Tank. This is an inactive waste management unit. The volume of the contents of the tank are unknown and it is not monitored. The tank was isolated in 1985. Unplanned release UPR-200-E-77 associated with a leaky jumper at diversion box 241-B-154 is related to this catch tank. Approximately 1 Ci of metal waste from the 221-B Building was leaked to the ground (WHC 1991a).

241-BX-302A Catch Tank. This inactive waste management unit is associated with the 241-BX Tank Farm. The volume of its contents are unknown and it is not monitored. The unit was isolated in 1985 and is weather covered.

241-BX-302B Catch Tank. This is an inactive waste management unit. The volume of the contents of the tank are unknown and it is not monitored. The tank was isolated in 1985.

241-BX-302C Catch Tank. This is an inactive waste management unit. The volume of the contents of the tank are unknown and it is not monitored. The tank was isolated in 1985. Unplanned release UPR-200-E-78 which involved 10 Ci of mixed fission product salt waste leaked from diversion box 241-BX-155 and is related to this catch tank (WHC 1991a).

241-B-361 Settling Tank. This settling tank is presently inactive. It received low salt, alkaline radioactive wastes from cell washings of 5-6W cell in 221-B Building and 224-B Building. It is estimated to contain 120,000 L (32,000 gal) of sludge including 2.46 kg (5.42 lb) of plutonium with 1,060 Ci of beta/gama activity (WHC 1991a). The solids are primarily bismuth phosphate. The unit was interim stabilized in 1985. It is noted that this tank is a relatively high radiological hazard in comparison with other 200 Area facilities.

241-ER-311 Catch Tank. This catch tank, an active waste management unit, is associated with the 241-ER 151 Diversion Box. It contains 6,680 L (1,765 gal) of material and was last pumped on June 29, 1991. Unplanned release UPR-200-84 is associated with this unit. In March 1953 a release to ground of about 7,570 L (2,000 gal) of concentrated acid with approximately 10 Ci of fission products occurred. Surface contamination of 90,000 ct/min was measured in October 1975 (WHC 1991a). Another source states that no ground contamination was detected (Stenner et al. 1988).

244-BXR Vault. This is an inactive waste management unit. The volume of its contents are unknown and it is not monitored. The vault is isolated and weather covered.

270-E Condensate and Neutralization Tank. This is an inactive unit located on the west side of the 216-B-64 Retention Basin. It is estimated to contain 14,000 L (3,800 gal) of sludge with activity of 100 ct/min direct and smearable and less than 0.5 mR/h penetrating (WHC 1991a). It is considered a relatively high radiological hazard relative to other 200

Area surplus facilities. Unplanned release UN-200-E-64 that occurred on October 12, 1984 may be associated with leakage from this unit. Contamination consisted of ^{137}Cs and ^{90}Sr (WHC 1991a). No clean-up action was taken.

4.1.2.3 Cribs and Drain Fields. The types of information available for the cribs, drains, and drain fields include inventory data, radiological survey results,and borehole geophysical data. Soil, vegetation, and air monitoring data are generally unavailable for these sites, as there are no sampling locations in these areas. Inventory and radiological information have largely been compiled from the WIDS database and the HISS database (Stenner et al. 1988). Table 4-14 compares the waste volume received by a waste management unit with its calculated specific retention capacity.

4.1.2.3.1 216-B-7A and 7B Cribs. The 216-B-7A and -7B Cribs are posted as an area of surface contamination. The April 1990 radiological survey found 1.2 mR/h contamination in the north end of the area. Similar contamination was detected in March 1989 (WHC 1991a). Current inventory data for the crib are summarized in Tables 2-3 and 2-4. Radionuclides contained in the waste stream at the time of discharge included 1 Ci of ^{60}Co, 100 Ci of ^{137}Cs, 5,600 Ci of ^{90}Sr, 600 Ci of ^{106}Ru, 4,300 g of plutonium, and 180 kg of uranium (Maxfield 1979) (Fecht et al. 1977).

Vadose Wells 299-E33, -58, -59, and -73 monitor the soil column beneath the crib site. Comparison of the estimated pore volume and the quantity of effluent disposed of suggest that the effluent has potential to reach groundwater (Table 4-14). Groundwater test results indicate that ^{137}Cs, ^{60}Co, ^{3}H, and alpha contamination are detectable in groundwater samples taken from Well 299-E33-18.

4.1.2.3.2 216-B-8TF Crib and Tile Field. The 216-B-8TF Crib and Tile Field is posted as a zone of surface contamination, and is located within a larger zone surface contamination.

The March 1992 radiological survey detected surface contamination of 6,000 dis/min beta. The 1992 survey also found one growing tumbleweed with a reading of 30,000 dis/min (WHC 1991a). Radionuclides contained in the waste stream at the time of discharge included 1 Ci of ^{60}Co, 50 Ci of ^{137}Cs, 15 Ci of ^{90}Sr, 50 Ci of ^{106}Ru, 30 g of plutonium, and 45 kg of uranium (Maxfield 1979).

Inventory data for the crib are summarized in Tables 2-3 and 2-4. Vadose Wells 299-E33-16, -66, -67, -68, -69, -70, -71, -72, and -89 monitor the soil beneath the crib. Scintillation probe profiles indicate groundwater contamination has not occurred beneath this site (Fecht et al. 1977).

4.1.2.3.3 216-B-9TF Crib and Tile Field. This unit is posted with surface contamination (around the cave-in potential area) and underground radioactive material placards. The April 1990 survey found several areas with up to 60,000 dis/min, similar to levels found in 1989. No surface contamination was detected in March 1992 (WHC 1991a). Radionuclides contained in the waste stream at the time of discharge included 0.1 Ci of ^{60}Co, 10 Ci of ^{137}Cs, 15 Ci of ^{90}Sr, 100 Ci of ^{106}Ru, 170 g of plutonium, and 45 kg of uranium (Maxfield 1979).

Inventory data for the crib are summarized in Tables 2-3 and 2-4. Vadose Wells 299-E28-53, -54, -55, -61 and 299-E28-1, -5, -6, -56, -57, -58, and -60 are used to monitor radionuclide concentration in the soil beneath the crib and the tile field respectively. Scintillation probe profiles suggest the contaminants are suspended near the surface in the sediment column and have not contaminated groundwater (Fecht et al. 1977). In April 1949, a well that was drilled at an 85 degree angle to bottom out directly under the crib was found filled with sediment to within 7.3 m (24 ft) of the surface; a sediment sample from this well had 1,830 μCi of fission products and alpha contamination of 14,800,000 dis/min/kg of sediment (Brown and Ruppert 1950). The well casing was found to be corroded from the acid introduced to the crib, indicating that liquids were introduced at approximately 46 m (150 ft) below ground surface.

4.1.2.3.4 216-B-10A Crib. The 216-B-10A Crib is posted as an area of underground radioactive materials. Radionuclides contained in the waste stream at the time of discharge included 0.1 Ci of ^{60}Co, 1 Ci of ^{137}Cs, 5 Ci of ^{90}Sr, 10 Ci of ^{106}Ru, 9.8 g of plutonium, and 9.1 kg of uranium (Maxfield 1979). No contamination was detected in the March 1992 survey, and there has been no change since the March 1988 survey (WHC 1991a).

Inventory data for the crib are summarized in Tables 2-3 and 2-4. Vadose Well 299-E28-17 monitors the soil column beneath the 216-B-10A and 216-B-10B Cribs. The well is located 18.3 m (60 ft) southeast of the 216-B-10A Crib and radiation levels are at or below background levels (Fecht et al. 1977).

4.1.2.3.5 216-B-10B Crib. The 216-B-10B Crib is posted as an area of underground radioactive materials. No contamination was detected in the March 1992 survey (WHC 1991a).

Inventory data for the crib are summarized in Tables 2-3 and 2-4. Vadose Well 299-E28-17 monitors the soil column beneath the 216-B-10A and 241-B-10B Cribs. The well is located 18.3 m (60 ft) southeast of the 216-B-10A Crib and radiation levels are at or below background levels (Fecht et al. 1977).

4.1.2.3.6 216-B-12 Crib. This crib consists of three wooden boxes in a cascade series. It has recently been posted underground radioactive material. No contamination was detected in the March 1992 survey. This unit was abandoned when a flow restriction was observed. There had been a gradual subsidence, with a final result of about a 1.5 m (5 ft) depression (WHC 1991a). Inventory data for the crib are summarized in Tables 2-3 and 2-4. The crib is monitored by Wells E28-9, E28-16, E28-65 and E28-66. A comparison of the estimated pore volume under the crib and the volume of effluent disposed suggests that breakthrough to groundwater could have occurred at this unit (Table 4-14).

4.1.2.3.7 216-B-14 Crib. Cribs 216-B-14 through -19 are located in the BC Controlled Area, south of the 200 East Area. During January 1956 to December 1957 they received 120,000,000 L (32,000,000 gal) of high-salt scavenged waste from 221-U Building. This BC disposal site received the greatest amount of radioactivity disposed of at any one site on the Hanford Project (920,000 gross beta curies) (Maxfield 1979).

Three wells were drilled at the BC Site in 1966 to determine the distribution of radionuclides below the selected areas. The results of core analyses from these wells indicated that the bulk of the long-lived radionuclides were retained high in the soil column, from 45.7 to 76.2 m (150 to 250 ft) above the water table as it existed at that time (Maxfield 1979).

Radionuclides contained in the 216-B-14 Crib waste stream at the time of discharge included 5 Ci of ^{60}Co, 250 Ci of ^{137}Cs, 400 Ci of ^{90}Sr, 59,000 Ci of ^{106}Ru, 25 g of plutonium, and 220 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

Vadose Wells 299-E13-1, -2, -3, -4, -5, -20, and -21 are used to monitor the soil column beneath the crib site. Scintillation probe profiles indicate that the radioactive contaminant plume may extend to the groundwater below the 216-B-14 and 216-B-16 Cribs (Fecht et al. 1977).

4.1.2.3.8 216-B-15 Crib. The 216-B-15 Crib is located in the BC Controlled Area, south of the 200 East Area. It is identified as an underground radioactive materials zone by concrete marker posts.

Radionuclides contained in the 216-B-15 Crib waste stream at the time of discharge included 5 Ci of ^{60}Co, 200 Ci of ^{137}Cs, 200 Ci of ^{90}Sr, 22,000 Ci of ^{106}Ru, 5 g of plutonium, and 100 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

4.1.2.3.9 216-B-16 Crib. The 216-B-16 Crib is located in the BC Controlled Area, south of the 200 East Area. It is identified as an underground radioactive materials zone by concrete marker posts.

Radionuclides contained in the 216-B-16 Crib waste stream at the time of discharge included 5 Ci of ^{60}Co, 650 Ci of ^{137}Cs, 700 Ci of ^{90}Sr, 13,000 Ci of ^{106}Ru, 10 g of Pu, and 320 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

Vadose Wells 299-E13-1, -2, -3, -4, -5, -20, and -21 are used to monitor the soil column beneath the crib site. Scintillation probe profiles indicate that the radioactive contaminant plume may extend to the groundwater below the 216-B-14 and 216-B-16 Cribs (Fecht et al. 1977).

4.1.2.3.10 216-B-17 Crib. The 216-B-17 Crib is located in the BC Controlled Area, south of the 200 East Area. It is identified as an underground radioactive materials zone by concrete marker posts.

Radionuclides contained in the 216-B-17 Crib waste stream at the time of discharge included 1 Ci of ^{60}Co, 220 Ci of ^{137}Cs, 160 Ci of ^{90}Sr, 250 Ci of ^{106}Ru, 10 g of plutonium, and 350 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

4.1.2.3.11 216-B-18 Crib. The 216-B-18 Crib is located in the BC Controlled Area, south of the 200 East Area. It is identified as an underground radioactive materials zone by concrete marker posts.

Radionuclides contained in the 216-B-18 Crib waste stream at the time of discharge included 5 Ci of ^{60}Co, 250 Ci of ^{137}Cs, 190 Ci of ^{90}Sr, 19,000 Ci of ^{106}Ru, 10 g of plutonium, and 240 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

The soil overlying the 216-B-18 Crib was discovered to have collapsed approximately 0.3 m (1 ft), during a field inspection in February 1974. There was no exposure of the crib to the air. The collapse was filled-in with gravel (Maxfield 1979).

4.1.2.3.12 216-B-19 Crib. The 216-B-19 Crib is located in the BC Controlled Area, south of the 200 East Area. It is identified as an underground radioactive materials zone by concrete marker posts.

Radionuclides contained in the 216-B-19 Crib waste stream at the time of discharge included 5 Ci of ^{60}Co, 270 Ci of ^{137}Cs, 200 Ci of ^{90}Sr, 5,100 Ci of ^{106}Ru, 10 g of plutonium, and 180 kg of uranium (Maxfield 1979). However, no contamination was detected in the November 1991 radiological survey. Inventory data for the crib are summarized in Tables 2-3 and 2-4.

4.1.2.3.13 216-B-43 Crib. The 216-B-43 through -50 Cribs (collectively known as the 241-BY Cribs) are inactive waste management units located adjacent to the northern boundary of the 241-BY Tank Farm. These cribs consist of four vertical concrete pipes, set below grade in a square pattern, and fed by a central pipe that branches into a chevron pattern to feed each culvert. The culverts are set on a gravel bed (Stenner et al. 1988). The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 m) long, the are placed 2 m (7 ft) below grade, set on a 1.5 m (5 ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 ft) apart in a 4.6 x 4.6 x 9 m (15 x 15 x 30 ft) deep excavation (DOE/RL 1991a).

Extensive remedial investigation/feasibility study (RI/FS) work has begun in the 200-B-1 Operable Unit. This unit includes cribs 216-B-43 through 50, 216-B-57, and 216-B-61. The RI/FS work plan was published in March 1990 (DOE/RL 1990a) and the Phase I RI activities began in 1991 and are currently ongoing. Initial work covers source sampling and analysis (Task 2), vadose zone sampling and analysis (Task 4), and groundwater sampling and analysis (Task 7). Preliminary remedial technologies for soil and groundwater have been identified and are being evaluated. This work is mentioned here; however, it is preliminary and no data from the RI/FS is included in this AAMSR.

Inventory data for the crib are summarized in Tables 2-3 and 2-4. Vadose Boreholes 299-E33-1, -2, -3, -4, -5, -6, -7, -13, -22, -23, -24, -25, and -26 monitor the soil column and unconfined aquifer beneath the BY Crib area. Scintillation probe profiles indicate that radionuclides are present in vadose zone soils into the water table, with elevated radioactivity at distinct intervals. This could indicate lateral migration of radionuclides by perching of crib effluents on less permeable strata during crib operation or from leaks in the 241-BY Tank Farm (DOE 1990). Groundwater samples from the area around the 241-BY Cribs contain cyanide, ^{90}Sr, ^{99}Te, ^{60}Co, nitrate, and beta. Nitrate and cyanide plumes are distinctly associated with the 241-BY Crib area, suggesting that the cribs may be a source. In 1956, a monitoring well near the BY cribs detected ^{60}Co in exceedance of the Hanford Atomic Products Operation (HAPO) concentration limits (4×10^{-5} μCi/ml) by over 300 times.

The 216-B-43 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The April 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-1 monitors the soil column beneath the crib. The waste volume discharged to the 216-B-43 Crib did not exceed its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

In 1991 the area around the 216-B-43 to -50 and 216-B-57 Cribs was interim stabilized. This was done to eliminate surface contamination and migration deficiencies and to maintain environmental compliance until the final remediation strategy is implemented. Stabilization activities included removing debris, resurveying, conspicuously marking all above-grade structures, covering contaminated areas with cobble, rock, and clean soil, and reposting the area as underground radioactive material.

4.1.2.3.14 216-B-44 Crib. The 216-B-44 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-2 monitors the soil column beneath the site. The waste volume discharged to this unit exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.15 216-B-45 Crib. The 216-B-45 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Similar results were found during the March 1988 survey. Vadose Borehole 299-E33-3 monitors the soil column beneath the crib. The waste volume discharged to this unit exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.16 216-B-46 Crib. The 216-B-46 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-4 monitors the soil column beneath the site. The waste volume discharged to the 216-B-46 Crib exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.17 216-B-47 Crib. The 216-B-47 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-5 monitors the soil column beneath the crib. The waste volume discharged to this unit exceed its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.18 216-B-48 Crib. The 216-B-48 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-6 monitors the soil column beneath the site. The waste volume discharged to the 216-B-48 Crib exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.19 216-B-49 Crib. The 216-B-48 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-6 monitors the soil column beneath the crib. The waste volume discharged to this unit exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

4.1.2.3.20 216-B-50 Crib. The 216-B-50 Crib is enclosed within a surface radiation zone and a radioactive underground materials zone. The March 1990 survey found spots of beta contamination from 6,000 to 20,000 dis/min. Vadose Borehole 299-E33-7 monitors the soil column beneath the site. The waste volume discharged to the 216-B-50 Crib vastly exceed its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

The 216-B-50 Crib did not receive waste until January 1965 because of elevated ^{60}Co and ^{137}Cs levels in groundwater. In 1956, a monitoring well near the 216-BY Cribs had ^{60}Co levels exceeding the HAPO concentration limits of 0.00004 μCi by over 300 times. The decision to use the 216-B-50 Crib for In-Tank Solidification (ITS) system condensate was made following 8 to 9 years of observations when it was shown that the groundwater activity levels were definitely decreasing.

4.1.2.3.21 216-B-55 Crib. The active 216-B-55 Crib is a 230 m (750 ft) long waste disposal site located approximately 200 m (600 ft) west of 221-B Building. It is 3 m (10 ft) wide and 4 m (12 ft) deep. It is composed of a perforated 30 cm (12 in.) pipe that runs the length of the unit three ft above the bottom. The excavation is filled with gravel, and has side slopes of 1.5:1 (DOE/RL 1991a).

The crib became operational in September 1967 (Maxfield 1979). It was designed to receive low level liquid wastes (steam condensate) from the 221-B Building. Radioisotopes present within the waste stream include ^{241}Am, ^{137}Cs, ^{139}Pu, ^{106}Ru, ^{90}Sr, and ^{3}H (Brown et al. 1990; Aldrich 1984). Well E28-12 monitors the 216-B-55 Crib. Only background radioactivity is detected in the well September 1989 survey. No change in activity has been detected since the previous survey (Fecht et al. 1977). The March 1992 radiological survey found spots of contamination up to 2,000 dis/min beta activity.

4.1.2.3.22 216-B-56 Crib. The 216-B-56 Crib, located approximately 150 m (500 ft) north of 7th street near the center of the 200-BP-5 Operable Unit, was designed to receive organic wastes from 221-B Building; however, the pipeline to the unit was not installed because disposal practices were changed and discharge of organic wastes to the ground was prohibited (Maxfield 1979).

Vadose Borehole 299-E28-14 monitors the soil column beneath the site. Scintillation probe profiles indicate only background activity levels (Fecht et al. 1977).

The WIDS indicates that the site had to be filled with gravel after cross-contamination occurred from surrounding sites. No contamination was detected in the March 1992 radiological survey.

4.1.2.3.23 216-B-57 Crib. The 216-B-57 Crib is enclosed within a surface contamination zone. The bottom of the excavation is 3 m (10 ft) below grade, and the dispersal pipe is approximately 2 m (7 ft) below grade. Radiological surveillance of the crib is done annually. At the April 1990 survey extensive contamination was found up to 350,000 dis/min on the site and around the outside perimeter. At the March 1992 survey, no contamination was detected. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Borehole 299-E33-24 monitors the soil column beneath the trench site. Scintillation probe profiles indicate the radioactive contaminant plume is suspended in the sediment column from 7.6 to 19.8 m (25 to 65 ft) below the ground surface (Maxfield 1979). The waste volume discharged to the 216-B-57 Crib greatly exceeded its calculated specific retention capacity (see Section 2.3.3 and Table 4-14).

In 1991 contaminated soil from the open area between the 216-B-43 through -50 Cribs, 12th Street, and Baltimore Avenue was excavated and placed on top of the 216-B-43 through -50 Cribs and the 216-B-57 Crib. The areas were then capped with clean soil and re-posted with underground radioactive material warning signs (prior to remedial activities, crib and trench areas were posted with surface contamination signs). Recent drilling activities at the cribs required that the sites be re-posted with surface contamination warning signs.

4.1.2.3.24 216-B-60 Crib. The 216-B-60 Crib has been covered by the northeast corner of the 225-B Encapsulation Facility (Maxfield 1979). Consequently, it cannot be surveyed, and there are no postings for it. The inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.3.25 216-B-61 Crib. The 216-B-61 Crib is enclosed in a light weight chain barricade. The 216-B-61 Crib was designed to receive waste storage tank condensate from the ITS system No. 1 unit in the 241-BY Tank Farm. Although this crib was built, it was never used (WHC 1991a).

Monitoring Boreholes 299-E33-25 and -26 monitor the soil column beneath the crib. Although no waste was reportedly disposed to the crib, monitoring well data indicate low-level contaminants are present. The source of these contaminants is unknown (WHC 1991a).

4.1.2.3.26 216-B-62 Crib. This crib is enclosed within a surface contamination zone. The pipe that feeds the crib is approximately 3 m (10 ft) below grade. No contamination was detected in the March 1992 radiological survey.

Wells 299-E28-18, -E28-20, and -E28-21 monitor the 216-B-62 Crib. Radionuclides exceeding background activity were detected between 11 and 29 m (36 and 95 ft) below the ground surface in Well 299-E28-18. The WIDS database reports that the total alpha decay (directly related to ^{234}U and ^{238}U concentration) in Wells 299-E28-18 and -E28-21 is continually decreasing, although in Well 299-E28-18 concentrations of ^{234}U and ^{238}U exceeded the concentration limits prior to August 1986.

Current activity in these wells averages about 15 pCi/L which is below the Administrative Control Value of 60 pCi/L. The Administration Control Value for various radionuclides is described in the annual environmental surveillance reports of the Westinghouse Hanford Company (Schmidt et al. 1991). The concentrations of uranium in the groundwater have remained below this limit since 1989 (Schmidt et al. 1992). It is suspected that the uranium is most likely originating from under the inactive 216-B-12 Crib located several hundred feet to the south.

4.1.2.3.27 Chemical Tile Field North of 2703-E HWSA. This tile field is an inactive waste site located about 245 m (800 ft) west of Baltimore Avenue and 4th Street and 60 m (200 ft) east of Atlanta Avenue. The tile field received mixed waste while in operation. It is enclosed within a light chain barricade with no warning signs. Radionuclide inventories are not available in the WIDS data sheets.

4.1.2.3.28 216-B-13 French Drain. The bottom of this french drain is approximately 4.5 m (18 ft) below grade. It is enclosed by a light chain barricade and marked as a surface radiation, underground radioactive materials zone with cave-in potential. The french drain has a plywood cover and is filled with crushed limestone. Radionuclide content is estimated to be less than 1 Ci total beta (Maxfield 1979). No contamination was detected in the March 1992 radiological survey. The french drain has a plywood cover and is filled with crushed limestone.

4.1.2.3.29 216-B-51 French Drain. The french drain is posted as a surface contamination zone. The bottom of the drain is approximately 4.2 m (14 ft) below grade. Radionuclide content is estimated to be less than 10 Ci total beta (Maxfield 1979). Beta contamination up to 4,000 dis/min was detected in the March 1992 radiological survey.

Monitoring Wells 299-E33-11 and 299-E33-14 monitor the groundwater beneath the site. Based on scintillation probe profiles and estimated waste inventory, groundwater contamination is not believed to have occurred at this site. A WIDS radionuclide inventory for this site was not available. It is assumed that the same radionuclides and chemicals disposed of at the BC site were also disposed of at this waste site (Fecht et al. 1977).

4.1.2.4 Reverse Wells. Reverse wells are injection wells with a perforated or open lower end. They were used for the disposal of low-level process waste. There are five reverse wells in the B Plant Aggregate Area.

4.1.2.4.1 216-B-4 Reverse Well. The 216-B-4 Reverse Well, operational from April 1945 to December 1949, received approximately 10,000 L (2,600 gal) of low salt, neutral to basic, transuranic fission waste. The WIDS hazardous chemical inventory lists only 1,000 kg (2,200 lb) of nitric acid contained in the waste stream. Radionuclide inventory for the reverse well was not available; however, Maxfield (1979) estimates less than 1 Ci total beta activity.

The 216-B-4 Reverse Well is classified as a zone of underground radioactive material and is marked by a concrete post, however, it is not contained within a barrier. Radiological surveillance is done annually. At the March 1992 survey no contamination was detected. There has been no change since the October 1988 survey.

4.1.2.4.2 216-B-5 Reverse Well. The 216-B-5 Reverse Well, operational from April 1945 to October 1947, is part of a system that includes the 241-B-361 Settling Tank. The system received approximately 30,600,000 L (808,000 gal) of low salt, neutral to basic waste that overflowed into the reverse well from the settling tank. The waste contained approximately 4,300 g of plutonium and 3,800 Ci of beta/gamma activity (Maxfield 1979). Other constituents of the waste stream at the time of discharge included 76 Ci of ^{90}Sr, 81 Ci of ^{137}Cs, and 160 Ci of ^{106}Ru. Analyses performed to determine the amount of uranium present in the waste indicated that less than 8% of the alpha activity could be attributed to uranium (Brown and Ruppert 1950).

Water level measurements made in 1947 and 1948 indicated that the reverse well penetrated the groundwater by as much as 3 m (10 ft) (Smith 1980). The site was immediately deactivated and eleven monitoring wells were drilled to determine the extent of groundwater contamination. This showed a zone of groundwater contamination of less than 20×10^{-7} μCi/L extending approximately 600 m (2,000 ft) from the reverse well (Smith 1980).

According to a study done by Smith in 1980, sediment samples from monitoring wells were analyzed for ^{239}Pu, ^{240}Pu, ^{137}Cs, and ^{90}Sr. This showed that radionuclides exceeding 10 nCi/g were limited to within 6 m (20 ft) of the reverse well, and levels of ^{239}Pu, and ^{240}Pu exceeding 100 nCi/g were limited to within 1 m (3 ft). Cesium-137 distribution showed that it moved laterally away from the reverse well in a silt layer in the unsaturated sediments at the basalt surface. A widespread layer of contamination located just above the basalt surface was revealed by gamma scintillation logging. The general direction of the contamination is to the southeast, consistent with the groundwater flow. Studies of groundwater contamination near the reverse well shows radiation levels are orders of magnitude less than drinking water standards, therefore, the sorbed radionuclide plumes are causing no contamination problems in the groundwater (Smith 1980).

Eleven wells were drilled around the reverse well to determine the extent of groundwater contamination. The water was found to contain less than 20 x 10^{-7} pCi/L; contaminated water was found to extend 600 m (2,000 ft) laterally from the well (Fecht et al. 1977). Samples from monitoring wells 15 m (50 ft) away from the injection well did not have plutonium-contaminated soil or water (though plutonium was injected directly into the groundwater), indicating that the plutonium was deposited onto sediments less than 15 m (50 ft) away (Brown and Ruppert 1950). Sediment sampling results are listed in Table 4-19.

The 216-B-5 Reverse Well is classified as an area of surface and underground contamination. It is marked by a concrete post, and surrounded by a light chain barrier. Radiological surveillance is done annually. At the April 1990 survey general contamination of 1,500 to 3,000 dis/min was found in the northeast corner of the zone. Two areas outside the zone perimeter were reported to have contamination of 15,000 dis/min and 4,000 dis/min (WHC 1991a). This is an increase from the 1989 survey. The March 1992 survey detected spotty beta contamination up to 6,000 dis/min.

4.1.2.4.3 216-B-6 Reverse Well. The 216-B-6 Reverse Well, operational from April 1945 to December 1949, received approximately 6,000,000 L (1,600,000 gal) of mixed waste. The waste stream included both nitric and sulfuric acids, as well as transuranic fission products. However, the site contains less than 10 Ci total beta (WHC 1991a).

The 216-B-6 Reverse Well is classified as a zone of underground radioactive material and is marked by a concrete post; however, it is not contained within a barrier. Radiological surveillance is done annually. At the March 1992 survey no contamination was detected. There has been no change since the October 1988 survey.

4.1.2.4.4 216-B-11A and 216-B-11B Reverse Wells. The 216-B-11A and 216-B-11B Reverse Wells are two units placed approximately 18 m (60 ft) apart. They were operational from December 1951 to December 1954 and received approximately 29,600,000 L (7,820,000 gal) of low salt, neutral to basic process condensate from the 242-B Evaporator (Maxfield 1979).

A study done by Fecht et al. in 1977 reports that radioactive contaminants were detected 22.9 m (7 ft) below the ground surface in vadose monitoring Borehole 299-E33-20, and 27.4 m (89.9 ft) below the surface in Borehole 299-E33-19 (Fecht et al. 1977).

The 216-B-11A and 216-B-11B Reverse Well area is classified as a zone of surface contamination. It has been covered by gravel and clean soil and is surrounded by a light chain barrier. Radiological surveillance is done annually. At the April 1990 survey general contamination of 3,000 to 5,000 dis/min was found. An area along the east side measured up to 2 mR/h. The March 1992 survey detected spotty areas of up to 6,000 dis/min beta activity.

4.1.2.5 Ponds, Ditches, and Trenches. The 216-B-3 Pond system consists of a main pond and three interconnected lobes, as well as several ditches leading to the ponds. The three expansion ponds are the 216-B-3A, 216-B-3B, and 216-B-3C Ponds. The ditches associated with the pond system include the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches, as well as the 216-A-29 Ditch. The 216-A-29 Ditch, which was backfilled in 1991, will not be discussed in this report as it is a part of the PUREX Plant Aggregate Area. Several additional ponds, ditches and trenches are also discussed in this section.

4.1.2.5.1 216-B-3 Pond. The 216-B-3 Pond is the main pond portion of the active 216-B-3 overflow pond and ditch system. It is currently classified as an area of surface contamination and is surrounded by a light chain barrier.

There has been only one known unplanned release directly associated with the 216-B-3 Pond. Unplanned release UN-200-E-14 occurred in 1958 when a dike broke along the east side of the 216-B-3 Pond, allowing water to flow out of the pond. After the break was repaired, the area was covered with clean soil. No isotope identification or curie level release was mentioned in the WIDS. However, the area was released from radiation zone status in December 1970.

Four other unplanned releases, UPR-200-E-32, UPR-200-E-34, UPR-200-E-51, and UPR-200-E-138, are also associated with the 216-B-3 Pond through its integral relationship with its tributary ditches. However, these four releases are more directly associated with the individual ditches in which they occurred and are discussed with the recipient ditches.

Currently, 216-B-3 Pond is part of four interconnected ponds that receive cooling water and other associated streams. Water samples of 1 L (0.26 gal) are collected weekly and the pH is determined. The weekly samples are composited and analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation samples are taken yearly to determine the root uptake of radionuclides from potentially contaminated sediments. Sediment samples are also taken yearly to measure the accumulation of radionuclides. The sediment and vegetation samples are analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium. The August 1991 radiological survey detected general beta contamination up to 4,000 dis/min. This is an increase from previous years. According to a study done by Mitchell in 1988, all constituents monitored were below the EPA Interim Primary Drinking Water Standards with the exception of ^{3}H, which was as high as 54,000 pCi/L in Borehole 699-45-42. However, ^{3}H levels have been decreasing since 1971.

Currently, the 216-B-3 Pond is in Groundwater Assessment due to high values of TOC and TOX detected in several RCRA wells north of the 216-B-3B lobe in June 1990. From June 1990 to July 1991, no sampling took place because of difficulties with a contract laboratory. Groundwater sampling of the 216-B-3 Pond was reinstated in July 1991.

4.1.2.5.2 UN-200-E-14. This release occurred in 1958 when the dike along the east edge of 216-B-3 Pond broke allowing water to escape. The quantity of water and amount of radioactivity released were undetermined. The area was released from radiation zone status in December 1970.

4.1.2.5.3 216-B-3A Pond. The 216-B-3A Pond is an active mixed waste management unit that was constructed in 1983 to receive the increased discharge resulting from the restart of PUREX operations.

Water samples from the pond are analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation and sediment samples are taken yearly and analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium. The 1990 survey detected 0.9 pCi/g Sr-90 in the sediment samples (Schmidt et al. 1992).

4.1.2.5.4 216-B-3B Pond. The 216-B-3B Pond is listed as an active waste management unit in the WIDS data sheets. However, it has been dry and unused since 1985. Although the pond is currently dry, the pipelines to the unit are still in place and it could be used in the event of high water flow, so it remains in active status. The pond was dredged in 1986. At that time up to 2.2 m (7 ft) of material was removed to a level equal to the channels in the bottom of the pond. The removed material was placed along the north shore of the 216-B-3 Pond.

There is a light chain barricade around the entire pond and it has "Danger" warning signs. Within the barricade, there is a second light chain barricade surrounding the inlet ditch. It is posted with surface radiation contamination warning signs.

4.1.2.5.5 216-B-3C Pond. The 216-B-3C Pond has been active since its construction in 1985. It was built to handle increased discharge to the 216-B-3 Pond system arising from the decommissioning of the Gable Mountain Pond. This lobe is the largest of the three and currently disposes of essentially all of the 216-B-3 Pond system's flow.

Water samples are analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation and sediment samples are taken yearly and analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium.

According to the 1990 survey, the 216-B-3C Pond had a total alpha concentration of 53 pCi/L in the groundwater, which is higher than the Derived Concentration Guide limit of 30 pCi/L. The sediment samples showed 33 pCi/g of plutonium, 110 pCi/g of ^{137}Cs, and 63 pCi/g of $^{144}CePr$ (Schmidt et al. 1992).

4.1.2.5.6 216-A-25 Pond. The 216-A-25 Pond, also known as Gable Mountain Pond, was active from 1957 to 1987. Over that time, it is estimated that the pond received approximately 307,000,000,000 L (8,110,000,000 gal) of low-level mixed waste (WHC 1991a).

In 1964, a reported 10,000 Ci of radionuclides were released when a cooling coil ruptured in the PUREX Plant (UPR-200-E-34). The following radionuclides have been detected in the Gable Mountain Pond soil samples: ^{241}Am, ^{3}H, ^{106}Ru, ^{137}Cs, ^{147}Pm, ^{90}Sr, and plutonium (WHC 1991a).

In 1984, increases in the ^{90}Sr concentration in Borehole 699-53-47A prompted an investigation and additional monitoring wells were installed. The investigation concluded that the ^{90}Sr plume was localized and moving so slowly as to have no significant impact at the Hanford Site boundary (Serkowski and Jordan 1989).

Cleanup of the Gable Mountain Pond started in July 1984 and was completed in December 1988. The unit was backfilled with clean pit run soil and cobbles to a minimum of 0.6 m (2 ft) above the original shoreline. Bentonite clay was also placed on the bottom of the pond as an attempt to tie-up the radionuclides in the upper sediment layers.

Concentrations of ^{90}Sr have remained relatively stable over the last few years with values ranging from below detection (5 pCi/L) in some locations to approximately 360 pCi/L in other areas (Serkowski and Jordan 1989). Although this is higher than the Administrative Control Value of 74 pCi/L, it is still much lower than the Derived Concentration Guide value of 1,000 pCi/L.

Radiological surveillance of the pond is done semiannually. At the October 1990 survey no contamination was detected and there has been no change since the May 1989 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.7 216-N-8 Pond. The 216-N-8 Pond, also known as West Pond (or West Lake), has never received direct discharges of contaminated effluent. The source of the existing activity is currently unknown; however, it may be the result of evaporative concentrations of fallout and/or subsurface migratory transport from Gable Mountain Pond (Meinhardt and Frostenson 1979).

The 216-N-8 Pond is particularly high in alkaline and phosphate levels, which is attributed to the disposal of sanitary sewage sludge from the early Hanford construction camp in the basin where West Pond later appeared.

Since 216-N-8 Pond does not receive direct liquid effluent discharges from processing facilities, only limited radiological data are available. According to a study done by Meinhardt and Frostenson (1979) the 216-N-8 Pond contained 0.5 pCi/ml of total beta activity and 0.1 pCi/ml of total alpha activity. The actual concentrations of radionuclides did not reveal any unusual levels of activity.

Water samples are analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation and sediment samples are taken yearly and analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium.

At the February 1990 survey no radiological surface contamination was detected and there has been no change since the 1988 survey.

4.1.2.5.8 2101-M Pond. The 2101-M Pond, which became operational in 1953, receives small amounts of steam condensate and evaporative cooler overflow drainwater from the 2101-M heating and air conditioning system. The pond has also received barium chloride laboratory waste solutions at an estimated volume of less than 1,893 L/yr (500 gal/yr). During the active life of the Basalt Waste Isolation Project (BWIP) Laboratory, solutions of dissolved barium in groundwater samples were discharged to the pond. Other laboratory chemicals may have been discharged to the pond from 1981 to July 1985. Administrative controls were established in July 1985 to prohibit disposal of dangerous wastes.

Detailed records documenting the wastes generated and the amounts of these wastes that may have been discharged to the pond were not maintained. Some wastes that may have been released to the pond from BWIP Laboratory include barium, sodium hydroxide, and dilute acid.

The soil characterization and groundwater data from the pond strongly suggest that the constituents in the soil and the groundwater beneath the pond are present in concentrations that do not pose a substantial present or potential threat to human health or the environment. The pond is encompassed by a light-weight chain barricade with "RCRA Waste Site Do Not Disturb" and "Dry Rot" warning signs.

4.1.2.5.9 216-E-28 Pond. The 216-E-28 Pond is listed as an inactive waste management unit in the WIDS data sheets. It was constructed in 1986 and 1987 as an emergency facility for temporary use in the event of an abrupt shutdown of the 216-B-3 Pond. To date, the contingency pond has not been used, and there are no inventory data included in the WIDS (WHC 1991a).

4.1.2.5.10 216-B-2-1 Ditch. The 216-B-2-1 Ditch is classified as an area of surface and subsurface contamination. There is no barrier surrounding the contaminated zone. One unplanned release, UPR-200-E-32, is associated with this ditch. It resulted in the release of 30 Ci of ^{144}Ce, and 0.05 Ci of ^{90}Sr. In 1964, the first 305 m (1,000 ft) of the 216-B-2-1 ditch was closed and backfilled with 1.8 m (6 ft) of clean soil. An additional 55 cm (22 in.) of sand covered with 10 cm (4 in.) of gravel was placed on the site in 1973 (Maxfield 1979).

This ditch is surveyed semiannually. At the April 1991 survey vegetation was found to contain beta contamination up to 20,000 dis/min. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.11 UPR-200-E-32. This unplanned release occurred November 7, 1963 when the 216-B-2-1 Ditch and the 207-B Retention Basin were contaminated with the cesium-rare earth fraction of the fission product stream, primarily ^{144}Ce, after a coil leak developed in the 221-B Building 6-1 Tank (Maxfield 1979). The total volume of liquid to be discharged to the ditch during this incident was estimated to be 4,900,000 L (1,300,000 gal), 4,200,000 L (1,110,000 gal) of which were low activity level cooling water. Cerium-141 content was determined insignificant. Only 30 Ci of ^{144}Ce and 0.05 Ci of ^{90}Sr were considered persistent.

Approximately 305 m (1,000 ft) of the 216-B-2-1 Ditch was backfilled and replaced with a new ditch (216-B-2-2). Fresh soil was spread over the backfilled area.

4.1.2.5.12 216-B-2-2 Ditch. The 216-B-2-2 Ditch is classified as an area of subsurface contamination. There is no barrier surrounding the contaminated zone. This ditch was closed after UPR-200-E-138 and then backfilled to grade with 2.4 m (8 ft) of clean fill material.

The release, UPR-200-E-138, occurred in 1970 originating from the 8-1 Tank located in the 221-B Building. Approximately 1,000 Ci of ^{90}Sr was released. However, most of the contamination was contained in the ditches. The radionuclides reaching 216-B-3 Pond included approximately 13 Ci of ^{137}Cs, 50 Ci of ^{90}Sr, and 54 Ci of ^{144}Ce. Bulldozers pushed soil over the north, south, and west shorelines of the 216-B-3 Pond reducing radioactivity from a maximum of 650 mR/h to 10 mR/h at the ditch inlet. Other measurements around the pond ranged from 1,000 ct/min to 25,000 ct/min (Maxfield 1979).

Russian thistles and willow trees which grew on the backfilled area showed internal beta-gamma contamination up to a maximum of 3,000 ct/min prior to the covering of the first 731 m (2,400 ft) with sand and plastic root liners in 1973. Since that time no contaminated vegetation has been found while Russian thistles growing on the uncovered section of the ditch have shown readings up to 1,500 ct/min beta-gamma contamination (Maxfield 1979).

The radionuclides reported to be released to the ditch include ^{137}Cs, ^{90}Sr, and ^{239}Pu, and ^{240}Pu. Radionuclide data obtained from the WIDS data sheets indicated that 0.042 g of plutonium as well as 0.314 Ci of ^{137}Cs, and 147 Ci of ^{90}Sr remain beneath the clean backfill material.

This ditch is surveyed semiannually. At the April 1991 survey, vegetation was found with beta contamination up to 20,000 dis/min. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.13 UPR-200-E-138. This unplanned release occurred March 22, 1970, when a leaking manometer sensing line from the 8-1 Tank inside the 221-B Building emitted 1,000 Ci of ^{90}Sr. Radiation levels of 500 rem/h were found 8 cm (3 in.) from the pipe gallery. Water samples in the 216-B-3 Pond reached a maximum strontium concentration of 1.7×10^{-3} μCi/ml (Maxfield 1979).

4.1.2.5.14 216-B-2-3 Ditch. The 216-B-2-3 Ditch is classified as an area of subsurface contamination. There is no barrier surrounding the contaminated zone. The ditch has been backfilled to grade with 2.4 m (8 ft) of clean soil, and replaced with a pipeline.

The 216-B-2-3 Ditch is surveyed semiannually. At the April 1991 survey, vegetation was found with beta contamination up to 20,000 dis/min. This was an increase from the previous year. The site is considered one of low-level radioactivity with readings that are generally less than 200 ct/min by a GM probe (Maxfield 1979). No radionuclide data were presented for this site in the WIDS sheets for decays through December 1989.

4.1.2.5.15 216-B-3-1 Ditch. The 216-B-3-1 Ditch, operational from April 1945 to July 1964, is classified as an area of subsurface contamination. It is surrounded by a light chain barrier and posted with underground radioactive material warning signs. It was backfilled to grade with 1.8 m (6 ft) of clean soil in 1964, after approximately 2,500 Ci of fission products were released to the ditch from UPR-200-E-34. In 1971, it was covered with a 10 mil thick plastic root barrier, 45 cm of sand, and 10 cm of gravel.

Prior to the 1971 stabilization, Russian thistle was growing profusely over areas of the covered ditch. Radiation measurements of up to 40 mrads/h were observed on surfaces of the thistle (Maxfield 1979). During a routine surveillance in 1984, contamination was found as follows: spotty contamination of soil up to 50,000 ct/min, vegetation up to 100,000 ct/min, coyote feces up to 2,000 ct/min, and animal burrows up to 12,000 ct/min (WHC 1991a).

The 216-B-3-1 Ditch is surveyed semiannually. During the March 1992 survey, no contamination was detected. This is a decrease from the October 1990 survey.

Radionuclide data for the 216-B-3-1 Ditch is not available in the WIDS; however, it is stated by Maxfield (1979) that 3 Ci of mixed waste were discharged to the ditch during its operational lifetime.

4.1.2.5.16 UPR-200-E-34. This unplanned release occurred in June 1964 when a coil leak in the F-15 Purex Tank resulted in the release of an estimated 10,000 Ci of short and long-lived fission products to the 216-B-3-1 Ditch, 216-B-3 Pond, and Gable Mountain Pond. Readings of 2 R/h in the ditch bank 2.5 m (8 ft) from the inlet and 150 mR/h along the pond road were discovered. Remedial action was taken to kill the algae and precipitate the fission products. The inlet ditches were covered with soil (WHC 1991a).

After the June 1964 unplanned release, bentonite clay was placed on the bottom of the 213-B-3 Pond in an attempt to reduce the migration of contamination, and to chemically tie up the radionuclides in the upper sediment layers of the pond.

4.1.2.5.17 216-B-3-2 Ditch. The 216-B-3-2 Ditch, operational from July 1964 to September 1970, is classified as an area of subsurface contamination and is surrounded by a light chain barrier. The ditch was backfilled to grade with between 1.2 and 2.4 m (4 and 8 ft) of clean backfill material in 1970, immediately following the release of an estimated 1,000 Ci of Sr-90 (UPR-200-E-138). This unplanned release led to readings at the head of the ditch of 450 mR/h, and general activity along the ditch averaging 10,000 ct/min. After the bottom was covered with 0.3 m (1 ft) of soil, readings were reduced to 20 mR/h at the head of the ditch, and 200 ct/min of general activity along the ditch (Maxfield 1979).

Since being completely backfilled, the 216-B-3-2 Ditch has been surveyed semiannually. No contamination was detected in the March 1992 survey. This is a decrease from previous years.

4.1.2.5.18 216-B-3-3 Ditch. The 216-B-3-3 Ditch is an active waste management unit classified as an area of surface contamination. It is surrounded by a light chain barrier.

Water samples are analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation and sediment samples are taken yearly and analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium.

Radiological surveys are also performed annually. No contamination was detected during the February 1992 survey. This is a decrease from previous years. This ditch is associated with the unplanned release UPR-200-E-51.

4.1.2.5.19 UPR-200-E-51. This unplanned release occurred May 18, 1977 when 15 kg of cadmium was released (in cadmium nitrate solution) from the 202-A Building storage tank TK-324 to the 216-B-3-3 Ditch and the 216-B-3 Pond. There is no record of any cleanup action (WHC 1991a).

4.1.2.5.20 216-B-20 Trench. From 1952 to 1958, liquid wastes containing uranium and fission products resulting from the bismuth phosphate separations process were removed from underground storage tanks for uranium recovery. After the uranium was recovered, the cesium and strontium content of the effluent stream was reduced by precipitate scavenging. The resultant supernatant liquor was released to the ground in the BC Cribs and Trenches (216-B-20 through -34, 216-B-53A, -53B, -54, and 58 Trenches). The whole BC Trenches area is encompassed by concrete market posts, some of which are connected with chains.

The 216-B-20 Trench was the first BC trench to receive this supernatant. It is classified as an area of underground radioactive contamination and was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 the unit was covered with 15 cm (6 in.) of gravel.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.21 216-B-21 Trench. The 216-B-21 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 the unit was covered with 15 cm (6 in.) of gravel.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data is summarized in Tables 2-3 and 2-4.

4.1.2.5.22 216-B-22 Trench. The 216-B-22 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 the unit was covered with 15 cm (6 in.) of gravel.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.23 216-B-23 Trench. The 216-B-23 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.24 216-B-24 Trench. The 216-B-24 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous year. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.25 216-B-25 Trench. The 216-B-25 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.26 216-B-26 Trench. The 216-B-26 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 layers of sand and gravel were put over the trench to bring it up to 3 m (10 ft) above the bottom, and to avoid radionuclide uptake by plants.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.27 216-B-27 Trench The 216-B-27 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 layers of sand and gravel were put over the trench to bring it up to 3 m (10 ft) above the bottom to avoid radionuclide uptake by plants. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.28 216-B-28 Trench. The 216-B-28 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1958 a burrow into this trench was found. It is believed that animals used the burrow to get at salt crystals formed from the waste. The burrow was filled with gravel and covered with asphalt. The asphalt has since broken up (WHC 1991a).

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.29 UN-200-E-83. In May 1958 radioactive rabbit and coyote feces were found scattered over the ground surface of the desert as far as 2.5 mi south, east, and west of the BC Cribs and Trenches. It is supposed that a badger or some other animal burrowed into the 216-B-28 Trench and exposed a radioactive salt layer. Rabbits and coyotes ingested the contaminated salts and defecated over an approximately 4 mi^2 area of undisturbed land covered by sagebrush and cheat grass. Surface contamination is spread throughout. This is a low activity site with approximately 81 Ci of ^{90}Sr and 14 Ci of ^{137}Cs remaining fixed in the rabbit and coyote feces (Maxfield 1979). This contaminated area, known as the BC Controlled Area, was given the unplanned release number UN-200-E-83.

Monthly and quarterly surveillance reports indicate the contamination is fixed beneath the vegetation. There is no significant evidence of resuspension of the radioactive particulate matter.

4.1.2.5.30 216-B-29 Trench. The 216-B-29 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.31 216-B-30 Trench. The 216-B-30 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.32 216-B-31 Trench. The 216-B-31 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.33 216-B-32 Trench. The 216-B-32 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.34 216-B-33 Trench. The 216-B-33 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. To avoid the possibility of plant uptake of radionuclides, the unit was covered with sand and gravel in 1969.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.35 216-B-34 Trench. The 216-B-34 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. In 1969 layers of sand and gravel were put over the trench to bring it up to 3 m (10 ft) above the bottom and to avoid radionuclide uptake by plants.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.36 216-B-35 Trench. The 216-B-35 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine and an herbicide was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Boreholes 299-E8, -10, -21, -286, -287, -288, -289, and -290 monitor the soil column beneath the trenches. Scintillation probe profiles indicate the radioactive contaminant plume is suspended in the soil above groundwater (Fecht et al. 1977).

4.1.2.5.37 216-B-36 Trench. The 216-B-36 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.38 216-B-37 Trench. The 216-B-37 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.39 216-B-38 Trench. The 216-B-38 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m(2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.40 216-B-39 Trench. The 216-B-39 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.41 216-B-40 Trench. The 216-B-40 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the 1989 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.42 216-B-41 Trench. The 216-B-41 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.43 216-B-42 Trench. The 216-B-42 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and approximately 1 m (2 ft) of topsoil treated with 2,4-d amine was added and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done annually. At the April 1992 survey no contamination was detected and there has been no change in activity since the March 1988 survey. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.44 216-B-52 Trench. The 216-B-52 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade with excavated material, which was stored adjacent to it. The area has been stabilized with gravel and weed growth has been controlled by a sterilent.

Radiological surveillance of the trench is done infrequently. At the September 1984 survey no contamination was detected. Current inventory data are summarized in Tables 2-3 and 2-4.

4.1.2.5.45 216-B-53A Trench. The 216-B-53A Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and the area was stabilized by adding 1 m (2 ft) of topsoil and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Borehole 299-E13-61 monitors the soil column beneath the trenches. Considering a depth to groundwater at about 103 m (338 ft) below ground surface, a low PNL Hazardous Ranking System Migration Score, and relatively small quantities of waste discharged to the facilities suggest the waste in the sediment column has not reached groundwater (Fecht et al. 1977).

4.1.2.5.46 216-B-53B Trench. The 216-B-53B Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and the area was stabilized by adding 1 m (2 ft) of topsoil and seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Borehole 299-E13-61 monitors the soil column beneath the trenches. Considering a depth to groundwater at about 103 m (338 ft) below ground surface, a low PNL Hazardous Ranking System Migration Score, and relatively small quantities of waste discharged to the facilities suggest the waste in the sediment column has not reached groundwater (Fecht et al. 1977).

4.1.2.5.47 216-B-54 Trench. The 216-B-54 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and the area was stabilized by adding 1 m (2 ft) of topsoil which was seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Borehole 299-W13-61 monitors the soil column beneath the trenches. Considering a depth to groundwater at about 103 m (338 ft) below ground surface, a low PNL Hazardous Ranking System Migration Score, and relatively small quantities of waste discharged to the facilities suggest the waste in the sediment has not reached groundwater (Fecht et al. 1977).

4.1.2.5.48 216-B-58 Trench. The 216-B-58 Trench is classified as an area of underground radioactive contamination. It was backfilled to grade and the area was stabilized by adding 1 m (2 ft) of topsoil which was seeded with thickspike, crested, and Siberian wheatgrass.

Radiological surveillance of the trench is done semiannually. At the November 1991 survey spots of up to 80,000 dis/min beta activity were detected. This is an increase from the previous survey. Current inventory data are summarized in Tables 2-3 and 2-4.

Vadose Borehole 299-E13-61 monitors the soil column beneath the trenches. Considering a depth to groundwater at about 103 m (338 ft) below ground surface, a low PNL Hazardous Ranking System Migration Score, and relatively small quantities of waste discharged to the facilities suggest the waste in the sediment column has not reached groundwater (Fecht et al. 1977).

4.1.2.5.49 216-B-59 Trench. The 216-B-59 Trench was designed to receive B Plant cooling water with radionuclide concentrations above those allowed for ponds. The site was activated in 1967 and only received one delivery of approximately 477,000 L (126,000 gal) of waste. The trench was then upgraded to a retention basin (216-B-59B Retention Basin).

The 216-B-59B Retention Basin is currently an active waste management unit. It is surrounded by a 2 m (6 ft) high chain-link fence. Yellow contamination flags are adjacent to the western boundary.

4.1.2.5.50 216-B-63 Trench. The 216-B-63 Trench was constructed in 1970 to receive chemical sewer wastes from the 221-B Building. Routine discharges to the trench were discontinued in February 1992.

The effluent stream is continuously monitored at two locations for radiation. Water samples are analyzed monthly for total alpha, total beta, and gamma-emitting radionuclides, and Sr-90. A 1 L (0.26 gal) sample is collected quarterly for nitrate analysis. Aquatic vegetation and sediment samples are taken yearly and analyzed for gamma-emitting radionuclides, Sr-90, Pu-239, and uranium. The trench has not received dangerous waste since September 1985 and no contamination has been detected on the survey plots. There has been no change since the July 1988 survey (WHC 1991a). Sample data are shown in Appendix A.

4.1.2.6 Septic Tanks. None of the septic tanks in the B Plant Aggregate Area are reported to have received hazardous waste; consequently there are no radiological data provided for them in the WIDS data sheets. The volume of sanitary wastewater and sewage received by each septic tank per day is reported in Table 4-20.

4.1.2.7 Transfer Facilities, Diversion Boxes, and Pipelines. Transfer facilities connect major processing facilities with each other and with various waste disposal and storage facilities. For the B Plant Aggregate Area they include process lines and diversion boxes. The process lines are not waste management units according to the Tri-Party Agreement and they will be addressed in detail under a separate decommissioning and decontamination program. However, process lines with associated unplanned releases will be discussed in this section. Only limited radiological data are available for diversion boxes in the B Plant Aggregate Area. Most of the data is summarized from the WIDS sheets (WHC 1991a).

4.1.2.7.1 241-B-151 Diversion Box. The 241-B-151 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1945 to June 1984. Two known unplanned releases (UPR-200-E-4 and UPR-200-E-73) resulting in radionuclide contamination are associated with this site.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this site.

4.1.2.7.2 UPR-200-E-4. This unplanned release occurred in the fall of 1951 when leakage from the 241-B-151 Diversion Box contaminated the surrounding soil. Mixed fission products of approximately 10 Ci were released. Most of the contamination was removed and buried. The remainder was covered with 0.3 m (1 ft) of clean soil (Stenner et al. 1988).

4.1.2.7.3 UPR-200-E-73. This unplanned release occurred in the summer of 1952 when leakage and spills from the 241-B-151 Diversion Box contaminated the surrounding soil with approximately 10 Ci of mixed fission products. Most of the contamination was removed. The remainder was covered with 0.3 m (1 ft) of clean soil. The area was delimited with a chain link fence and posted "Underground Contamination" (Stenner et al. 1988).

4.1.2.7.4 241-B-152 Diversion Box. The 241-B-152 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1945 to June 1984. Two known unplanned releases (UPR-200-E-74 and UPR-200-E-38) resulting in radionuclide contamination are associated with this site.

Leak detection and air monitoring are performed continuously within the 241-B Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this site.

4.1.2.7.5 UPR-200-E-74. This unplanned release occurred in the spring of 1954, when an area approximately 15 m^2 near the 241-B-152 Diversion Box was contaminated with approximately 1 Ci of fission products while work was being performed (Stenner et al. 1988). Most of the contamination was removed and buried. The remainder was covered with several inches of clean soil. The area was delimited with rope and posted with radiation zone signs. A radiological survey in October 1975 measured surface contamination up to 30,000 ct/min.

4.1.2.7.6 UPR-200-E-38. This unplanned release occurred January 4, 1968, when a waste line leading to the 241-B-152 Diversion Box leaked 221-B cell waste, causing an area northeast of the box to cave-in. Unknown beta/gamma was found with readings of 2,000 to 6,000 ct/min. The blacktop area was contaminated with readings of 20 to 30 mR/hr (Stenner et al. 1988). The hole was backfilled, and dose rates were reduced from 5 rem/h to 20 mrem/h. The area outside the 241-B Tank Farm was zoned off.

4.1.2.7.7 241-B-153 Diversion Box. The 241-B-153 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1945 to June 1984. Two known unplanned releases (UPR-200-E-6 and UPR-200-E-75) resulting in radionuclide contamination are associated with this unit.

Leak detection and air monitoring are performed continuously within the 241-B Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this site.

4.1.2.7.8 UPR-200-E-6. This unplanned release occurred in 1954 when leakage from the 241-B-153 Diversion Box contaminated the soil in the immediate vicinity. Approximately 1 Ci of mixed fission products were released. The contamination was covered with clean gravel (DOE 1988b).

4.1.2.7.9 UPR-200-E-75. This unplanned release occurred between 1954 and 1955 when work on the 241-B-153 Diversion Box resulted in a general buildup of contamination. Approximately 1 Ci of fission products were released (Stenner et al. 1988). The contamination covered area has been covered with clean gravel.

4.1.2.7.10 241-B-154 Diversion Box. The 241-B-154 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1945 to June 1984. Contamination is estimated to be high in alpha, beta, and gamma (WHC 1991a). Two unplanned releases, UPR-200-E-77 and UN-200-E-45, are associated with this unit.

Leak detection and air monitoring are performed continuously within the 241-B Tank Farm, in which this diversion box is located. It has been isolated and weather covered. A radiological survey in October 1975 measured surface contamination up to 80,000 ct/min. It has been covered with 0.3 m (1 ft) of clean soil; however, recontamination has occurred. Currently, it is classified as an area of surface contamination and is surrounded by a light chain barrier. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.11 UN-200-E-45. This unplanned release occurred on August 26, 1974 when cleanup activities at the 241-B-154 Diversion Box inadvertently contaminated an area of roadway in the immediate vicinity. The contaminated road was washed off with water, and the borrow pit slopes were bladed. The contaminated soil was removed and placed in a burial trench (WHC 1991a).

4.1.2.7.12 UPR-200-E-77. This unplanned release occurred in 1946, as a result of work associated with a leaky jumper in the 241-B-154 Diversion Box. Metal waste solution from 221-B Building contaminated the ground around the box. The waste contained fission products measuring approximately 1 Ci. Immediately following the spill, the area was covered with 0.3 m (1 ft) of clean soil (WHC 1991a).

4.1.2.7.13 241-B-252 Diversion Box. The 241-B-252 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1945 to June 1984.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.14 242-B-151 Diversion Box. The 242-B-151 Diversion Box received liquid mixed waste from 1945 to June 1984. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.15 241-BR-152 Diversion Box. The 241-BR-152 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm, in which this diversion box is located. It has been isolated and weather covered. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.16 241-BX-153 Diversion Box. The 241-BX-153 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1983.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.17 241-BX-154 Diversion Box. The 241-BX-154 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to July 1985.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a light chain barrier. WIDS radionuclide inventories are not available for this unit.

4.1.2.7.18 241-BX-155 Diversion Box. The 241-BX-155 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1984. One unplanned release, UPR-200-E-78, is associated with this site.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, an area of approximately 60 m^2 around the unit is designated a zone of surface contamination. It is surrounded by tape and a chain fence, and posted with surface contamination signs. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.19 UPR-200-E-78. This unplanned release occurred on October 6, 1955 during pressure testing of lines and jumpers in the 241-BX-155 Diversion Box. Mixed fission product salt waste of approximately 10 Ci was released from the 221-B Building, contaminating about 60 m^2 of the surrounding soil causing a maximum dose rate of 22.6 rads/h on the ground surface (Stenner et al. 1988). The area has been covered with clean soil and is considered a low-activity site.

4.1.2.7.20 241-BXR-151 Diversion Box. The 241-BXR-151 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the site is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.21 241-BXR-152 Diversion Box. The 241-BXR-152 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.22 241-BXR-153 Diversion Box. The 241-BXR-153 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1948 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BX Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.23 241-BYR-152 Diversion Box. The 241-BYR-152 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1950 to June 1984.

Leak detection and air monitoring are performed continuously within the tank farm in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.24 241-BYR-153 Diversion Box. The 241-BYR-153 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1950 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BY Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.25 241-BYR-154 Diversion Box. The 241-BYR-154 Diversion Box, used for the transfer of waste solutions from processing and decontamination operations, received liquid mixed waste from 1950 to June 1984.

Leak detection and air monitoring are performed continuously within the 241-BY Tank Farm, in which this diversion box is located. It has been isolated and weather covered. Currently, the unit is classified as an area of surface contamination and is surrounded by a chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.26 241-ER-151 Diversion Box. The 241-ER-151 Diversion Box is currently used for cross-site process and decontamination waste. In March 1953, at least 6,435 L (1,700 gal) of contaminated acid were lost to the ground when its associated catch tank (241-ER-311 Catch Tank) developed a leak (UPR-200-E-84). A radiological survey in

October 1975 measured surface contamination of up to 90,000 ct/min at the site of the unplanned release (WHC 1991a).

This diversion box is not associated with any particular tank farm, however, leak detection and air monitoring are performed continuously. Currently, the unit is classified as an area of surface contamination and is surrounded by a 2 m (6 ft) chain link fence. The WIDS radionuclide inventories are not available for this unit.

4.1.2.7.27 241-ER-152 Diversion Box. The 241-ER-152 Diversion is currently used to transport radioactive waste solutions from processing and decontamination operations.

Leak detection and air monitoring are performed continuously at this site. Currently, it is classified as an area of surface contamination and is surrounded by a light chain barrier. WIDS radionuclide inventories are not available for this unit.

4.1.2.7.28 UN-200-E-1. On October 14, 1966 soil contamination from a suspected failure in the 221-B Building to 241-BX-154 Diversion Box waste line was detected near the 221-B Building. Test holes were driven to determine the extent of contamination, and the area was fenced and posted. The contaminated area was covered with sufficient soil and gravel to reduce readings to 2 mrem/h. Vegetation above the waste lines was removed. Test shafts were drilled adjacent to waste lines where they pass under roadways to investigate potential leakage. Hydrostatic tests later confirmed the suspected waste line failure in each of the five transfer lines installed for project C-112. Reexcavation of piping showed three major areas of electrolytic corrosion. The piping was removed and reinstalled in a v-shaped concrete trough, covered with concrete blocks, and sealed for water tightness.

4.1.2.7.29 UN-200-E-3. On November 21, 1951 the failure of the 221-B Building to 241-BX-154 Diversion Box first-cycle waste line resulted in the release of waste containing mixed fission products. Efforts to excavate and inspect for the cause of the leak were abandoned when readings of 120 R/h were met with 46 cm (18 in.) of soil still remaining over the pipe (WHC 1991a).

4.1.2.7.30 UN-200-E-7. On November 30, 1954 a leak in the 221-B Building to 241-B-361 Settling Tank waste line resulted in the release of 19,000 L (5,000 gal) of cell wash water containing a maximum dose rate of 1.7 R/h. The area of contamination covered 9 m^2 near the 216-B-9 Crib and Tile Field (Stenner et al. 1988). The contamination was covered and the unit was classified as an area of underground contamination. Currently, no barrier surrounds this unit and no markers indicate its location.

4.1.2.7.31 UN-200-E-44. On August 16, 1972 a leak in the BCS Crib line contaminated the soil and caused it to cave-in. No radioactive contamination was observed in or around the area of the cave-in. An exploratory pit revealed a leak in the BCS Crib line. The soil surrounding the pipe was contaminated with readings of 10,000 to 20,000 ct/min, and the pipe itself was contaminated with readings up to 20 mR/h. No cleanup action is documented in the WIDS data sheets (WHC 1991a), however, no spread of the contamination has occurred (DOE 1988b). The site is surrounded by a light chain barrier and marked as a zone of radioactive material.

4.1.2.7.32 UN-200-E-76. On January 4, 1968 a leak in the 221-B Building to 241-B-110 Tank pipeline contaminated soil near the 241-B-153 Diversion Box with 20,439 L (5,400 gal) of solution from the 9-2 Tank. The waste contained 4,780 Ci of ^{144}Ce, 340 Ci of ^{106}Ru, and 850 Ci of ^{95}Zr and niobium (Stenner et al. 1988). The unit was covered with clean gravel and is surrounded by a chain link fence. It is classified as an area of surface contamination.

4.1.2.7.33 UN-200-E-79. Five leaks in the 242-B Evaporator to 207-B Retention Basin waste line were discovered in June 1953. They resulted in a minor release of approximately 10 Ci of fission products (Stenner et al. 1988). Contamination levels up to 2,500 ct/min were measured at the points of emission (WHC 1991a). No determination of the activity below the ground surface was made. The area was backfilled with approximately 5 cm (2 in.) of clean soil. No barriers or signs mark this site.

4.1.2.7.34 UN-200-E-80. On June 17, 1946 a process sewer line from the 221-B Building leaked an unknown quantity of metal waste. The ground above the leak caved in, but was subsequently backfilled with several feet of clean gravel. The contaminated soil was removed and placed in the 200-E Dry Waste Burial Ground. Chronological records indicate that the 218-E-2 Burial Ground most likely received the waste. The leak site is considered one of low-activity with approximately 10 Ci of fission products at the time of release and less than 5 Ci still remaining (WHC 1991a). The contamination covers an area approximately 30 x 150 m (100 x 500 ft), south of the 221-B Building. It is surrounded by a light chain barrier and classified as a zone of surface contamination. "Surface stabilized area, no vehicles" warning signs are posted.

4.1.2.7.35 UN-200-E-85. On July 20, 1972 high radiation levels were detected in the R-13 utility pit adjacent to the 221-B Building. The 221-B Building to 241-BX-154 Diversion Box process line was suspected to have leaked high salt and neutral/basic wastes. Radiation levels of 15 rad/h were found in the northeast corner of the pit near the bottom. The radionuclide content of ^{137}Cs at the time of discharge was approximately 15 Ci. On December 31, 1973, it was estimated at 14 Ci (WHC 1991a). A radiological survey in 1975 measured no detectable contamination above 200 ct/min. The R-13 utility pit is covered with a steel lid. It is surrounded by a light chain barrier and is marked as a zone of surface contamination.

4.1.2.7.36 UN-200-E-87. It is believed that alpha-laden moisture seeped through the joints of the underground pipeline that ran from the 224-B Building to the drain tank pit south of the 221-B Building contaminating the subsoil. This could have occurred throughout its operational lifetime of 1945 to 1953. The seepage resulted in contamination of approximately 75 g of ^{239}Pu on the south side of the 224-B Building (Stenner et al. 1988). A September 1989 radiological survey detected no contamination, and there has been no change since the September 1988 survey. This unit is surrounded by two light chain barriers with underground radioactive material warning signs posted adjacent to the south side of the 224-B Building. No cleanup action is documented.

4.1.2.7.37 UN-200-E-103. On March 8, 1972 a hole in the BCS Crib line contaminated the soil south of the R-17 Change House. The release resulted in unknown beta/gamma readings of 1,500 ct/min (Stenner et al. 1988). The hole in the line was sealed with a filter and the area was barricaded as a radiation zone.

4.1.2.8 Basins. The 216-B-59B, 207-B, and 216-B-64 Retention Basins are the only basins in the B Plant Aggregate Area. Most of the data available for the basins and their associated unplanned releases are summarized from the WIDS sheets (WHC 1991a). Another basin facility, the Liquid Effluent Retention Facility (LERF), is currently under construction in the B Plant Aggregate Area.

4.1.2.8.1 216-B-59B Retention Basin. The 216-B-59B Retention Basin, originally the 216-B-59 Trench, has been an active waste site since December 1967. The original trench was designed to receive 221-B Building cooling water with radionuclide concentrations greater than those allowed for the ponds. The site only received one delivery of approximately 477,000 L (126,000 gal) of waste before being upgraded to a retention basin by adding a hypalon liner and changing the identification number to 216-B-59B.

The 216-B-59B Retention Basin, which held diverted cooling water to be reprocessed, was further upgraded by replacing the hypalon liner with a concrete liner and cover. Minor pumping and piping modifications were also made. No inventory data for this unit is presented in the WIDS sheets.

There is a 2 m (6 ft) high chain-link fence surrounding the basin and yellow contamination flags are adjacent to the western boundary. It is classified as an area of surface contamination. The identification number of the retention basin is scheduled to be changed back to 216-B-59.

4.1.2.8.2 207-B Retention Basin. The 207-B Retention Basin, active since its construction in April 1945, is classified as an area of surface contamination. It currently receives B Plant cooling water and chemical sewer waste from process equipment jackets in the 221-B Building. During the years of operation, the concrete walls of the retention basin were also contaminated by radioactive constituents in the streams passing through the unit. In 1953, the residual contamination in the walls was covered with a coat of tar sealant to prevent the spread of radionuclides.

One unplanned release associated with the 217-B-2-7 Ditch (UPR-200-E-32) resulted in small amounts of radionuclide contamination in the basin (see Section 2.3.5.10). Batch sampling and analysis of liquid effluents is performed and composited monthly. Radiological surveillance is done annually. At the July 1990 survey some specks of 200 to 600 ct/min were detected on the north side of the basin. The perimeters on the previous survey were less than detectable. No inventory data for this unit is presented in the WIDS sheets.

4.1.2.8.3 216-B-64 Retention Basin. The 216-B-64 Retention Basin was built in 1974 to receive steam condensate from the 221-B Building that exceeded release limits. The unit was used only once for an initial test, however, it is now classified as a zone of surface contamination (UN-200-E-64).

The 216-B-64 Retention basin is surrounded by a cyclone fence. Radiological surveillance is done annually. At the April 1990 survey an area of contamination was found along the west perimeter with readings of 60,000 dis/min. The March 1992 survey showed an increase to 1,000,000 dis/min beta activity. No inventory data for this unit is presented in the WIDS sheets.

4.1.2.8.4 UN-200-E-64. Unplanned Release UN-200-E-64 was discovered on October 12, 1984, and is located on the west side of 216-B-64 Retention Basin. It predominantly consists of ^{137}Cs and ^{90}Sr contamination up to 100,000 ct/min. The original source of the release has not been determined, but an uncapped riser on a nearby pipeline encasement and activities at the nearby 270-E Condensate Neutralization Tank have been considered. The contamination has been spread by burrowing ants so that the zone is approximately 2 acres in size. Pesticides and stabilization methods are being investigated to control the spread (Schmidt et al. 1991). The area has been chained and posted as a surface contamination zone. No cleanup action has been undertaken.

The 216-B-64 Retention Basin is surrounded by a cyclone fence. Radiological surveillance is done annually. At the April 1990 survey an area of contamination was found along the west perimeter with readings of 60,000 dis/min. There were similar findings on the previous survey. No inventory data for this unit is presented in the WIDS sheets.

4.1.2.8.5 Liquid Effluent Retention Facility. The LERF, currently undergoing construction immediately north of the 216-B-3 Pond, will be used for the temporary storage of effluent prior to its treatment and disposal. Effluents discharged to the LERF basins will be sampled, analyzed, and verified as complying with WAC 173-216 discharge acceptance criteria before being released to the 200 Areas treated effluent disposal basin.

4.1.2.9 Burial Sites. There are a total of twelve waste burial waste management units in the B Plant Aggregate Area. Five of these sites contain either non-hazardous, non-radioactive waste or have no detectable surface contamination. The seven remaining sites contain buried material contaminated with radioisotopes. All the sites are listed in Table 4-18 along with the reported radionuclide inventory values for the seven contaminated sites.

The waste buried in most of these sites generally consists of failed equipment and industrial wastes packaged in boxes. Wastes were transported to the burial grounds by railcar. Unless noted otherwise, the burial grounds are located in the 200-BP-10 Operable Unit, which includes the 218-E-2, -2A, -4, -5, -5A, -9, and -10 Burial Grounds.

4.1.2.9.1 200 East Powerhouse Ash Pit. This active site contains 81,000 yd^3 of ash from the 200 East Powerhouse (operable unit 200-SS-1). The pit commenced operation in 1943. The ash has been analyzed using the EP Toxicity Test and no hazardous material was found. An estimated 9,500 yd^3 of ash is added to the pit annually.

4.1.2.9.2 218-E-2 Burial Ground. This inactive site consists of nine waste trenches ranging in length from 27 to 140 m (90 to 465 ft) with a bottom width of 3 m (11 ft). The site started-up in 1945 and ceased operation in 1953. It contains failed equipment and industrial waste. Also known as the 200 East Industrial Waste Site No. 002, it is indistinguishable from the 218-E-9 Burial Ground. The site received 0.0031 m^3 of mixed MFP/TRU wastes. It has been backfilled. Radionuclide inventory values for this site are reported in Table 4-18. Maxfield (1979) reports that 300,000 g of uranium and 800 g of plutonium are buried in the 218-E-2 Burial Ground. Current inventory data are included in Tables 2-3 and 2-4.

4.1.2.9.3 218-E-2A Burial Ground. This site is also known as the Regulated Equipment Storage Site No. 02A and was active from 1945 until 1955. It consists of one trench. No surface contamination has been detected at the 281-E-2A Burial Ground.

However, unplanned release UPR-200-E-95 is associated with both the 218-E-2A and 218-E-5 Burial Grounds. The railroad spur between these two sites was used as an above ground storage area. Wastes were stored in boxes on railroad flatcars. The unplanned release is not the result of a single occurrence but is believed to be the accumulation of many small releases over time.

4.1.2.9.4 218-E-3 Burial Ground. This burial ground received waste for only a short time in 1954. It is located in the extreme southwest corner of operable unit 200-SS-1. Site material has been exhumed and analyzed and the site released from radiation zone status.

4.1.2.9.5 218-E-4 Burial Ground. This site is also known as 200 East Minor Construction No. 4 and is thought to consist of two trenches. It received repair and construction wastes from the modification of the 221-B Building during 1955 and 1956. Contaminated tumbleweeds have been a problem at this site. Radionuclide inventory values are reported in Table 4-18. Maxfield (1979) lists 1,000 g of uranium and 10 g of plutonium are buried in the 218-E-4 Burial Ground.

Unplanned release UPR-200-E-112 occurred near this burial ground on February 12, 1979. Contaminated liquid spilled out of an ion exchange column loaded in a burial box on a railroad flatcar in the B Plant Aggregate Area railroad tunnel. The contamination was carried out and along the tracks by one wheel of the railcar contaminating the right-of-way.

4.1.2.9.6 218-E-5 Burial Ground. From 1954 to 1956 this burial site received industrial dry wastes and small boxes. The north end of the site contains railroad boxcars contaminated with uranyl nitrate hexahydrate. In 1979 the two trenches were covered with fill. Radionuclide inventory values for this site are reported in Table 4-18. Contaminated tumbleweeds have been a past problem at this site. Unplanned release UPR-200-E-95, reported above with 218-E-2A Burial Ground, is associated with this burial ground. Maxfield (1979) reports that 120,000 g of uranium and 620 g of plutonium are buried in the 218-E-5 Burial Ground.

4.1.2.9.7 218-E-5A Burial Ground. Solid, mixed TRU waste is buried at this location. From 1956 to 1959 the site received four large boxes of failed equipment and industrial wastes and waste from L cell (202A Burial Package). The D-2 column from the PUREX K cell is also buried at the site. Potentially contaminated tumbleweeds are present. Radionuclide inventory values for this site are reported in Table 4-18. Maxfield (1979) reports that 120,000 g of uranium and 1,400 g of plutonium are buried in the 218-E-5 Burial Ground.

4.1.2.9.8 218-E-6 Burial Ground. This burial ground is a shallow 1.2 m (4 ft) deep trench in which a wooden shack and other wooden items were burned and covered over in the fall of 1955. The site has been exhumed and released from radiation zone status. It is located in operable unit 200-BP-6, south and across 7th Street from the railroad tunnel end of the 221-B Separations Building.

4.1.2.9.9 218-E-7 Burial Ground. The site consists of two wooden vaults and a concrete culvert pipe encasement and received mixed MFP/TRU wastes from 1947 to 1952.

Wastes consisted of laboratory and sample wastes from the 222-B Building with an estimated volume of 170 m^3 (6,000 ft^3). Maxfield (1979) reports that 1,000 g of uranium and 1 g of plutonium are buried in the 218-E-9 Burial Ground. It is adjacent to the 218-E-6 Burial Ground in operable unit 200-BP-6 and was also known as the 200 East 222-B Vaults. Heavy vegetation covers the site. Radionuclide inventory values for this site are reported in Table 4-18. Current inventory data are summarized in Table 2-3 and 2-4.

4.1.2.9.10 218-E-9 Burial Ground. This is a site of significant surface contamination as noted in Table 4-18. It is also known as the 200 East Regulated Equipment Storage Site No. 009. It was an above ground storage site covering 62,000 m^2. Fission product equipment that became contaminated in the uranium recovery program at the tank farm is buried at this location. There is a contaminated tumbleweed problem at the site.

Unplanned release UPR-200-E-61 is not associated with any individual burial ground but is attributed to the accumulated contamination that occurred at the railcar unloading ramp as a result of unloading and burial operations. It was declared on October 31, 1981, as a site of general beta and gamma contamination. The railroad right-of-way through the burial grounds was decontaminated.

4.1.2.9.11 200-E8 Borrow Pit Demolition Site. The 200-E8 Borrow Pit, a RCRA facility, received hazardous waste in 1984. No chemical or radiological data are available for this unit.

4.1.2.9.12 218-E-10 Burial Ground. This site consists of 10 existing trenches and 9 planned trenches for the disposal of solid, mixed industrial wastes. It has the highest radionuclide inventory of any B Plant waste management unit as shown in Table 4-18. The unit started in February, 1960, and is currently active.

The unit is surveyed semi-annually and is posted as underground radioactive material. Routine airborne radionuclide monitoring is performed. No surface contamination has been reported, however, a potential weed/tumbleweed problem has been noted. The unit is in compliance with the Environmental Compliance Manual.

4.1.2.9.13 200-East Area Construction Pit. The 200-East Area Construction Pit received nonhazardous solid waste from 1945 through 1955. There have been no known chemicals dumped into this unit. No chemical or radiological data are available.

4.1.2.10 Unplanned Releases. Information regarding unplanned releases that were not associated with other B Plant Aggregate Area waste management units is given in this section. A full review of all of the unplanned releases is contained in Table 2-6.

4.1.2.10.1 UN-200-E-2 Unplanned Release. On November 18, 1947 radioactive particles up to 1/32 in. were found around the stack with mist-like particles found in a larger area. The exhaust fan inlet and exhaust ducts were discovered as the sources. The components were altered to stainless steel metal and HEPA filters installed in the mid-1960's to eliminate further problems. Current emissions meet federal regulation limits. The immediate area around the stack has been marked with a light-weight chain.

4.1.2.10.2 UN-200-E-43 Unplanned Release. Liquid within 102-BY Pump being transported to burial leaked on an undocumented section of roadway on January 10, 1972, producing measurements of 1,000 to 100,000 ct/min (Stenner et al. 1988). The area was decontaminated.

4.1.2.10.3 UN-200-E-55 Unplanned Release. An area of the railway south of the K-3 filter and the gravel area southeast of the 212-B Building was contaminated from assumed wind-blown materials establishing a temporary radiation zone on August 27, 1979. Unknown beta/gamma readings from 5,000 to 30,000 ct/min were detected (Stenner et al. 1988). The area was cleaned and released from further monitoring.

4.1.2.10.4 UN-200-E-61 Unplanned Release. On October 31, 1981, the unloading ramp to the 200 East Burial Grounds was identified as an unplanned release are with readings of 100,000 ct/min (WHC 1991a). The cause was not identified as a single event, but assumed to have been caused by burial operations. The area was decontaminated to background levels and marked with a chain barricade.

4.1.2.10.5 UN-200-E-63 Unplanned Release. On June 4, 1981, a gravel pit outside of the BC Control Area was found to contain tumbleweeds contaminated to 100,000 ct/min and with unknown beta/gamma readings to 6,000 dis/min. The tumbleweeds were contaminated to uptake from the PC Controlled Area and were wind transported to the gravel pit. The vegetation was removed, and vegetation growth prevention spray program started in the BC Controlled Area (WHC 1991a).

4.1.2.10.6 UN-200-E-92 Unplanned Release. In 1981, a cleanup of soil contaminated by decomposing Russian Thistle that had accumulated on the east perimeter fence removed the soil and replaced it with clean material. The Russian Thistle had absorbed small amounts of strontium and cesium which has accumulated at the wind deposition area by the fence.

4.1.2.10.7 UN-200-E-95 Unplanned Release. Over a period time, the railroad spur between 218-E-2A and 218-E-5 Burial Grounds had been contaminated with small spills. In September, 1980, the radiation counts were measured at 200 to 400 ct/min with spots as high as 4,000 ct/min (WHC 1991a). Clean-up or demarcation was not documented.

4.1.2.10.11 UN-200-E-101 Unplanned Release. During 1986, the area between the 242-B Evaporator and the 241-B Tank Farm fence was found to be contaminated from presumed airborne particulate emissions from the 241-B Tank Farm. The contaminated weeds in the area were removed.

4.2 POTENTIAL IMPACTS TO HUMAN HEALTH AND THE ENVIRONMENT

This preliminary assessment is intended to provide a qualitative evaluation of potential human health and environmental hazards associated with the known and suspected contaminants at the B Plant Aggregate Area. The assessment includes a discussion of release mechanisms, potential transport pathways, develops a conceptual model of human and environmental exposure based on these pathways, and presents the physical, radiological, and toxicological characteristics of the known or suspected contaminants.

In developing the conceptual model, potential exposures to groundwater have not been addressed in detail. Since migration to groundwater is the primary route for potential future exposures to many of the chemicals disposed of at the site, this pathway (i.e., travel time, receptors) will be addressed in the 200 East Groundwater AAMSR.

It is important to note that these evaluations do not attempt to quantify potential human health or environmental risks associated with exposure to B Plant Aggregate Area waste management unit contaminants. Such a risk assessment cannot be performed until additional waste unit characterization data are acquired. Risk assessment activities will be performed in accordance with the *Hanford Baseline Risk Assessment Methodology* document (DOE/RL 1992b) being prepared in response to the M-29 milestone, which incorporates the requirements established in the *Risk Assessment Guidance for Superfund* (EPA 1989a) and the EPA Region 10 *Supplemental Risk Assessment Guidance for Superfund* (EPA 1991a).

The ability of this qualitative assessment to address potential environmental and ecological risks is severely constrained by the relative lack of data regarding potentially exposed biotic populations and exposure pathways. As was discussed in Section 3.6, past studies of biota have, for the most part, been conducted on a site wide basis and do not provide data that is useful in evaluating the potential impacts of the B Plant Aggregate Area. To the extent that B Plant Aggregate Area biota sampling has been conducted (Section 4.1.1.4), it has been limited to vegetation sampling. The role of biota in transporting contaminants through the environment is discussed in the sections that follow, and biota are included as receptors in the conceptual model. However, the assessment of potential ecological risks associated with biota exposure to B Plant Aggregate Area contaminants is currently constrained by the lack of data. This data gap is addressed in Section 5.0, and is discussed further in Section 8.2.3.

4.2.1 Release Mechanisms

The B Plant Aggregate Area waste management units can be divided into two general categories based on the nature of the waste released: (1) units where waste was discharged directly to the environment and (2) units where waste was disposed of inside a containment structure and bypassed an engineered barrier to reach the environment (e.g., through the vadose zone to the aquifer).

In the first group are those waste management units where release of wastes to the soil column was an integral part of the waste disposal strategy. Included in this group are tile fields, septic system drain fields, French drains, cribs and ditches without liners, reverse wells, and some disposal trenches. Also in this group are unplanned releases that involved waste material released to the soil. For this group of waste management units, if discharges to the unit contained contaminants of concern, it can be assumed that soils underlying the waste management unit are contaminated. The first task in developing a conceptual model for these units is to determine whether contaminants of concern are retained in soil near the waste management unit, or are likely to migrate to the underlying aquifer and then to receptor points such as drinking water wells or surface water bodies. Factors affecting migration of chemicals away from the point of release will be discussed in the following section.

In the second group are waste management units that were intended to act as a barrier to environmental releases. Included in this group are burial grounds containing drums or other containers, cribs and ditches with membrane liners, vaults, tanks, waste transfer facilities, and unplanned releases that occurred within containment structures. Waste management units that received only dry waste could also be included in this category, since the potential for wastes to migrate to soils outside of the unit is low due to the negligible natural recharge rate at the Hanford Site. For these waste management units, the first consideration to be addressed in developing a conceptual model is the integrity of the containment structure.

The ability of this report to evaluate the efficacy of engineered barriers is limited by the lack of vadose zone soil sampling data and air sampling data for many waste management units. Available sampling information for the waste management units and unplanned releases has been summarized in Section 4.1.

The efficacy and integrity of concrete liners (Retention Basins) and concrete and steel tanks (vaults) are well known and documented (see Anderson 1990 and Hanlon 1992) due to the long-term use of similar units in B Plant. For those units that received only dry wastes, such as gloves, pumps, contaminated dirt, and process equipment, the potential for release is expected to be low. However, small amounts of liquid wastes (tritium, lab wastes) are known to have been disposed of in these waste management units, and early disposal records (prior to about 1968) are incomplete. Thus, releases from these structures to the surrounding soil are possible.

In addition to evaluating releases to the subsurface, the conceptual model must address the potential for releases to air and, for radionuclides, the potential for direct irradiation. All units have some type of barrier to releases to the surface; however, barriers can fail over time or may not be designed to prevent migration by certain transport pathways (e.g., volatilization).

Some of the cribs and trenches in the B Plant Aggregate Area have experienced cave-ins or subsidence in recent years due to decomposition of the wooden framework (e.g., 216-B-18 Crib). Such collapse can lead to high levels of direct radiation at the surface and the potential for spread of contaminated materials by wind erosion. Westinghouse Hanford has an ongoing program to detect and remediate cave-ins by covering the cribs and trenches with additional soil, and any exposures from these incidents are generally short-term.

4.2.2 Transport Pathways

Transport pathways expected within the B Plant Aggregate Area are summarized in this section, including:

- Drainage and leaching from soil to groundwater
- Volatilization from wastes and shallow soils
- Wind erosion of contaminated surface soils
- Deposition of fugitive dust on soils, plants, and surface water
- Uptake from soils by vegetation
- Uptake from soils by animals via direct contact with soils or ingestion of vegetation, and
- Direct radiation.

In addition, transport within the saturated zone and subsequent release to groundwater wells or to off-site surface water (i.e., the Columbia River) is of potential concern, but will not be addressed in this document, since this topic will be the focus of the 200 East Groundwater AAMS.

4.2.2.1 Transport from Soils to Groundwater. Soil is the initial receiving medium for waste discharges in the B Plant Aggregate Area, whether the release is directly to soil or through failure of a containment system. Several factors determine whether chemicals that are introduced into the vadose zone will reach the unconfined aquifer, which lies at a depth of approximately 60 m (200 ft) below ground surface. These factors are discussed in the following sections.

4.2.2.1.1 Depth of Release. Waste management units that released wastes at a greater depth below the surface are more likely to contaminate groundwater than waste management units where the release was shallow. The 216-B-5 Reverse Well is a primary example of a deep release at the B Plant Aggregate Area. This unit discharged wastes to the vadose zone approximately 91 m (300 ft) below the surface.

4.2.2.1.2 Liquid Volume or Recharge Rate. For waste constituents to migrate to the underlying water table, some source of recharge must be present. In the B Plant Aggregate Area, the primary source of moisture for mobilizing contaminants are waste management units that discharge liquid waste to the soil column. As discussed in Section 3.5.2, estimates of natural precipitation recharge range from 0 to 10 cm/yr, primarily depending on surface soil type, vegetation, and topography. Gravelly surface soils with no or minor shallow rooted vegetation appear to facilitate precipitation recharge. One modelling study (Smoot et al. 1989) indicated that some radionuclide (^{137}Cs and ^{106}Ru) transport could occur with as little as 5 cm/yr of natural recharge. However, other researchers (Routson and Johnson 1990) have concluded that no net precipitation recharge occurs in the 200 Areas, particularly at waste management units that are capped with fine-grained soils or impermeable covers.

With respect to artificial recharge, some waste management units (e.g., the 216-B-12 Crib) were identified in which the known volume of liquid waste discharged substantially exceeded the total estimated soil pore volume present below the footprint of the facility. In this case, the moisture content of soil below the waste management units likely approached saturation during the periods of use of these facilities. Because vadose zone hydraulic conductivities are maximized at water contents near saturation, the volume of liquid wastewater historically discharged to the waste management units probably enhanced fluid migration in the vadose zone beneath these units.

Contaminants that are not initially transported to the water table by drainage may be mobilized at a later date if a large volume of liquid is added to the unit. In addition, liquids discharged to one unit could mobilize wastes discharged to an adjacent unit if lateral migration takes place within the vadose zone. There are no known cases of this occurring in the B Plant Aggregate Area, however the potential exists. A known example of this process occurred at the U Plant Aggregate Area 216-U-16 Crib, where lateral migration of acidic waste above a caliche layer mobilized radionuclides in the 216-U-1 and 216-U-2 Cribs (Baker et al. 1988).

4.2.2.1.3 Soil Moisture Transport Properties. The moisture flux in the vadose zone is dependent on hydraulic conductivity as well as gradients of moisture content or matrix suction. Higher unsaturated hydraulic conductivities are associated with higher moisture contents. However, higher unsaturated hydraulic conductivities may be associated with fine-grained soils compared to coarse-grained soils at low moisture contents. Because of the stratified nature of the Hanford Site vadose zone soils and the moisture content dependence of unsaturated hydraulic conductivity, vertical anisotrophy is expected, i.e., vadose zone soils are likely to be more permeable in the horizontal direction than in the vertical. This vertical anisotrophy may substantially reduce the potential for contaminant migration to the unconfined aquifer.

4.2.2.1.4 Retardation. The rate at which contaminants will migrate out of a complex waste mixture and be transported through unsaturated soils depends on a number of characteristics of the chemical, the waste, and the soil matrix. In general, chemicals that have low solubilities in the leaching fluid or are strongly adsorbed to soils will be retarded in their migration velocity compared to the movement of soil pore water. Studies have been conducted of soil parameters affecting waste migration at the Hanford Site to attempt to identify the factors that control migration of radionuclides and other chemicals. Recent studies of soil sorption are summarized in Serne and Wood (1990). Some of the processes that have been shown to control the rate of transport are:

- **Adsorption to Soils.** Most contaminants are chemically attracted to some degree to the solid components of the soil matrix. For organic compounds, the adsorption is generally to the organic fraction of the soil, although in extremely low-organic soils, adsorption to inorganic components may be of greater importance. Soil components contributing to adsorption of inorganic compounds include clays, organic matter, and iron and aluminum oxyhydroxides. In general, Hanford surface soils are characterized as sandy or gravelly with very low organic content (<0.1%) and low clay content (<12%) (Tallman et al. 1981). Thus, site-specific adsorption factors are likely to be lower, and rate of transport higher, than the average for soils nationwide.

- **Filtration.** Filtration of suspended particulates by fine-grained sediments has been suggested as a mechanism for concentration of radionuclides in certain sedimentary layers. This finding suggests that migration of suspended particulates may be an important mechanism of transport for poorly soluble contaminants.

- **Solubility.** The rate of release of some chemicals is controlled by the rate of dissolution of the chemical from a solid form. The concentration of these chemicals in the pore water will be extremely low, even if they are poorly sorbed. An example cited by Serne and Wood (1990) is the solubility of plutonium oxide, which appears to be the limiting factor controlling the release of plutonium from waste materials at neutral and basic pH.

- **Ionic Strength of Waste.** For some inorganics, the dominant mechanism leading to desorption from the soil matrix is ion exchange. Leachate having high ionic strength (high salt content) can bias the sorption equilibrium toward desorption, leading to higher concentrations of the contaminant in the soil pore water. Wastes within the B Plant Aggregate Area that can be considered high ionic strength include any releases from tanks.

- **Waste pH.** The pH of a leachant has a strong effect on inorganic contaminant transport. Acidic leachates tend to increase migration both by increasing the solubility of precipitates and by changing the distribution of charged species in solution. The exact impact of acidic or basic wastes will depend on whether the chemical is normally in cationic, anionic, or neutral form, and the form that it takes at the new pH. Cationic species tend to be more strongly adsorbed to soils than neutral or anionic species. The extent to which addition of acidic leachate will cause a contaminant to migrate will also depend on the buffering or neutralizing capacity of the soil, which is correlated with the calcium carbonate ($CaCO_3$) content of the soil. The soils in the Hanford formation beneath the B Plant Aggregate Area generally have carbonate contents in the range of 0.1 to 5%. Higher carbonate contents (20 to 30%) are observed within the Plio-Pleistocene caliche layer.

  Once the leaching solution has been neutralized, the dissolved constituents may re-precipitate or become reabsorbed to the soil. Observations of pH impacts on waste transport at the Hanford Site include:

  - The remobilization of uranium beneath the 216-U-1 and 216-U-2 Cribs in the U Plant Aggregate Area is believed to have occurred in part because of this introduction of low pH solutions.

- Leaching of americium from the Z Plant Aggregate Area 216-Z-9 Crib sediments was found to be solubility controlled and correlated to solution pH.

4.2.2.1.5 Complexation by Organics. Certain organic materials disposed of at the B Plant Aggregate Area are known to form complexes with inorganic ions, which can enhance their solubility and mobility. Tributyl phosphate is one of the primary organic complexing agent disposed of at the B Plant Aggregate Area. Cyanide is another example of a complexing agent disposed of at the B Plant Aggregate Area. This chemical complexes with ^{60}Co, making it more mobile.

4.2.2.1.6 Contaminant Loss Mechanisms. Processes that can lead to loss of chemicals from soils, and thus decrease the amount of chemical available for leaching to groundwater, include:

- **Radioactive Decay.** Radioactivity decays over time, generally decreasing the quantities and concentrations of radioactive isotopes.

- **Biotransformation.** Microorganisms in the soil may degrade organic contaminants such as kerosene and inorganic chemicals such as nitrate.

- **Chemical Transformation.** Hydrolysis, oxidation, reduction, radiolytic degradation and other chemical reactions are possible degradation mechanisms for contaminants.

- **Vegetative Uptake.** Vegetation may remove chemicals from the soil, bring them to the surface, and introduce them to the food web.

- **Volatilization.** Organic chemicals and volatile radionuclides can be transported in the vapor phase through open pores in soil either to adjacent soil or to the atmosphere. These volatilized compounds could include acetone, radon (a decay product of uranium), and tritium (HTO in tritiated water). Some elements (mainly fission products such as iodine, ruthenium, cerium, and antimony) are referred to as "semivolatiles" because they have a lesser tendency to volatilize.

4.2.2.2 Transport from Soils to Air. Transport of contaminants from waste management units to the atmosphere can occur by means of vapor transport or by fugitive dust emissions.

Vapor transport may occur from waste management units where volatile organics (e.g., CCl_4) or volatile radionuclides (^{14}C, $^{14}CO_2$, ^{129}I, or ^{3}H) have been released. Transport mechanisms include diffusion down a concentration gradient and gas-driven flow. Situations where the latter process may occur include production of methane gas from degradation of organic compounds in soil, or production of hydrogen and oxygen gases by radiolytic hydrolysis of water.

In order for fugitive dust emissions to occur, contaminants must be exposed at the surface of the waste management unit. A number of mechanisms could lead to exposure of contaminants in soil-covered waste management units. These mechanisms include uptake by vegetation, transport by animals, disruption of the waste management unit (e.g., cave-ins at cribs), and wind erosion. Wind erosion can strip off surface soil and uncover waste materials. This mechanism has been identified as an ongoing problem in some of the waste management unit areas. The processes by which biota may expose contaminated soils are discussed in Section 4.2.2.4.

The contribution of the B Plant Aggregate Area to the overall fugitive dust emissions at the Hanford Site is expected to be relatively minor, based on results of air monitoring downwind of the B Plant Aggregate Area waste management units.

4.2.2.3 Transport from Soils to Surface Water. The only surface water available in the B Plant Aggregate Area is at the 2101-M Pond, 216-B-3 Pond, 216-N-8 Pond, and the 216-B-3-3 Ditch. The 216-B-3 Pond System has four ponds, of which, only three currently contain surface water. These are the 216-B-3 main lobe and the 216-B-3A and 216-B-3C Lobes. The 216-B-63 Ditch is currently dry, but when containing liquid it could be used as a soil-to-surface water path.

Transport of contaminants to surface water bodies outside of the B Plant Aggregate Area via groundwater discharge and deposition of fugitive dust on water bodies are the primary pathways of potential concern for surface water effects. Groundwater discharge will be addressed in the 200 East Groundwater AAMSR. Fugitive dust emissions are discussed in the ensuing sections.

4.2.2.4 Transport from Soils to Biota. Biota, plants and animals, have the potential for taking up (bio-uptake), concentrating (bioaccumulating), transporting, and depositing contamination beyond its original extent. Transfer from one species to another in the food chain is also possible because of predation. The possibility of these processes contributing significantly to the transport of contamination from the B Plant Aggregate Area waste management units or to result in damage to the affected ecosystems is unclear. The currently available data, as described in Sections 3.6 and 4.1, is general in nature and not adequate for the purpose of evaluating of biotic transport or ecological risk. This data gap is discussed further in Section 5.0 and 8.0. The future acquisition of additional data will be guided by the requirements for human health and ecological risk assessments being documented in the

Hanford Baseline Risk Assessment Methodology document (DOE/RL 1991) being prepared in response to the M-29 milestone.

4.2.2.4.1 Uptake by Vegetation. Release of radioactivity to the surface by growth of vegetation is an ongoing problem at B Plant waste management units. Roots of sagebrush and other native species can take up radionuclides from soils below the surface and transport these chemicals to the foliage. Wind dispersal of portions of the contaminated vegetation, or entire plants (tumbleweeds) can lead to transport of contaminants outside of the unit. Westinghouse Hanford has an ongoing vegetation control (herbicide application, reseeding with shallow-rooted vegetation, and mechanical removal) and radiological survey program to prevent radioactivity from being transported by this mechanism. However, the program does not ensure complete removal of vegetation, and incidents of detection of contaminated vegetation are reported occasionally in the radiological surveys.

4.2.2.4.2 Transport by Animals. Disturbance of waste management unit barriers by animals occasionally leads to release of contaminants to the surface. Subsurface soils can be transported to the surface by burrowing animals, thus exposing contaminants for release to the air. Additionally, animals that become contaminated by direct contact with subsurface waste or through ingestion of subsurface contaminants (e.g., chemical salts) and contaminated vegetation, water, or other animals can spread contamination in their feces on the surface and outside of the waste management unit. An example of transport through this mechanism is the UN-200-E-83 Unplanned Release in the B Plant Aggregate Area, in which native wildlife burrowed into one of the operable trenches (216-B-23 Trench) and transmitted the contaminants to soils and vegetation to an area west and southeast of the BC Crib and trench area through feces and urine.

4.2.3 Conceptual Model

Figure 4-3 presents a graphical summary of the physical characteristics and mechanisms at the site which could potentially affect the generation, transport, and impact of contamination in the B Plant Aggregate Area on humans and biota (conceptual model).

The sources of contamination include process wastes (condensates, cooling water, sewage) from B Plant, U Plant, and PUREX Plant; condensate from the B Plant tank farms; laboratory wastes; drainage from diversion boxes; sanitary wastes; process feed materials; stack drainage and emissions; bismuth phosphate metal wastes; high level liquid wastes; low level waste; and contaminated equipment or waste material that was spilled during transit or disposed of in the burial grounds.

Contaminants from these sources have been disposed of at the waste management units that are under investigation. These include the 216-B-3 Pond, ditches, retention basins, diversion boxes, trenches, cribs, French drains, reverse wells, catch tanks, septic tanks and drain fields, burial grounds, single-shell tanks, vaults, the WESF storage pool, and the various unplanned releases that have occurred on the site. These releases and disposal activities are described in Sections 2 and 4.1. Some of the unplanned releases are associated with specific waste sites, and are shown on Figure 4-3 as dashed lines with "U" designations.

From these waste management units, various release mechanisms may have transported contamination to the potentially affected media. Volatilization could release chemicals from surface waters into the atmosphere. Materials in the ditches flowing toward B Pond may have seeped into the vadose zone, or deposited into the sediments in the ditch. Biota may have taken up contaminants from the surface water and near-surface contaminated soils (via deep roots or burrowing animals).

Many waste management units discharge their waste effluents directly to the near surface (vadose zone) soils. The trenches are potential release points via leaching or drainage of the liquid portion of the disposed materials. The cribs provide seepage discharge and similarly the French drains, reverse wells, and septic system drain fields directly inject their effluents into the subsurface sediments. The unplanned releases have mainly impacted surface soils although some contamination may have also taken place on building surfaces. Fugitive dust from sediment and surface soils has also been released or resuspended due to wind effects or surface disturbances, and some surface soils have been buried or removed to off-site disposal.

The primary mechanism of vertical contaminant migration is the downward movement of water from the surface through the vadose zone to the unconfined aquifer. The contaminants generally move as a dissolved phase in the water and their rate of migration is controlled both by groundwater movement rates, hydraulic conductivity and the degree of soil saturation, and by adsorption and desorption reactions involving the surrounding sediments. Some contaminants are strongly sorbed on sediments and their downward movement through the stratigraphic column is greatly retarded. Significant lateral migration of contaminants is restricted to perched water zones and to the unconfined aquifer, where water is moving laterally. Again adsorption and desorption reactions may greatly retard lateral contaminant migration. Contaminants that were introduced to the soil column outside of the aggregate area may migrate into the area along with perched or aquifer water.

There are four exposure routes by which humans (offsite and onsite) and other biota (plants and animals) can be exposed to these possible contaminants:

- Inhalation of airborne volatiles or fugitive dusts with adsorbed contamination

- Ingestion of surface water, fugitive dust, surface soils, biota (either directly or through the food chain), or groundwater

- Direct dermal contact with the waste materials (such as those exhumed by burrowing animals), contaminated surface soils, buildings, or plants, and

- Direct radiation from waste materials, surface soils, building surfaces, or fugitive dusts.

4.2.4 Characteristics of Contaminants

Table 4-20 is a list of radioactive and nonradioactive chemical substances that represent candidate contaminants of potential concern for this study based on their known presence in wastes, usage, disposal in waste management units, historical association, or detection in environmental media at the B Plant Aggregate Area. Table 4-21 summarizes the types of known or suspected contamination thought to exist at the individual waste management units. Known contaminants have been proven to exist from sampling and inventory data (Tables 2-3 and 2-4). Suspected contaminants are those which could occur at a site based upon historical practices or chemical associations. Given the large number of chemicals known or suspected to be present, it is appropriate to focus this assessment on those contaminants that have been detected through sampling efforts and which pose the greatest risk to human health or the environment.

The EPA Region 10 guidance on risk-based contaminant screening (EPA 1991a), as summarized in the *Hanford Baseline Risk Assessment Methodology* (DOE/RL 1992b), was consulted for the purpose of establishing the B Plant Aggregate Area contaminants of potential concern. That risk-based contaminant screening mostly involves comparing maximum contaminant concentrations to risk-based benchmark concentrations. However, for the B Plant Aggregate Area, contaminant concentrations in environmental media are not available, and direct risk-based screening could not be performed. To ensure that the intent of the EPA Region 10 approach could be achieved, an alternative, and more conservative, approach was developed. This requires B Plant Aggregate Area contaminants with potential risks to be included in the list of contaminants of potential concern. The alternative approach retains any contaminant that is known or suspected that is known or suspected of being a carcinogen or toxic, regardless of quantity or concentration.

Table 4-22 lists the contaminants of concern for the B Plant Aggregate Area. This list was developed from Table 4-20 and includes only those contaminants which meet the following criteria:

- Radionuclides that have a half-life of greater than one year. Radionuclides with half-lives less than one year will not persist in the environment at concentrations sufficient to contribute to overall risks.

- Radionuclides with a half-life of less than one year and are part of long-lived decay chains that result in the buildup of the short-lived radionuclide activity to a level of 1% or greater of the parent radionuclide's activity within the time period of interest. Although daughter radionuclides are adequately identified during normal parent radionuclide investigations, they are also identified as contaminants of concern through this criterion. This provides an additional level of assurance that all primary contaminants will be addressed.

- Contaminants that are known or suspected carcinogens or have a U.S. Environmental Protection Agency (EPA) noncarcinogenic toxicity factor. In addition, chemicals with known toxic effects but no toxicity factors are included. Several of the chemicals have known toxic effects but no toxicity criteria are presently available. In some instances the criteria have been withdrawn by EPA pending review of the toxicological data and will be reissued at a future date. Chemicals with known toxicity for which toxicity factors are presently not available include lead, selenium, kerosene and tributyl phosphate.

The following characteristics will be discussed for the contaminants listed in Table 4-24:

- Detection of contaminants in environmental media

- Historical association with plant activities

- Mobility

- Persistence

- Toxicity

- Bioaccumulation.

4.2.4.1 Detection of Contaminants in Environmental Media. The nature and extent of surface and subsurface soils, surface water, groundwater, air, and biota contamination have not yet been adequately characterized for the B Plant Aggregate Area. All recent environmental monitoring data were reviewed and summarized for each media in Section 4.1.

The most extensive monitoring data available has been for groundwater. Because groundwater will be evaluated in the 200 East Groundwater AAMSR, it will not be discussed further here. Surface soil and biota samples have been collected from locations on a regular rectangular grid. These sampling locations do not correspond to any of the waste management units, but are intended to characterize the B Plant Aggregate Area as a whole. Air and external radiation samples have been collected at several locations within or adjacent to the B Plant Aggregate Area. These sampling stations are also not located directly on any of the waste management units and therefore the sampling results cannot be attributed to any particular unit. The only routine sampling data that correspond directly to waste management units are the external radiation surveys, which are performed on a regular basis. There is little soil or vegetation sampling data available for any of the units.

4.2.4.2 Historical Association with B Plant Activities. Radionuclides that are known components of B Plant waste streams are listed in Table 2-9. This list includes chemicals in the process wastes as well as chemicals that were detected at elevated levels in wastewater. Since these waste streams are known to have been disposed of directly to the soil column in some waste management units, it is probable that the chemicals on this list have affected environmental media.

Based on the WIDS data (WHC 1991a), radionuclides that are known to have been disposed of to B Plant waste management units in the greatest quantities are as follows:

- ^{239}Pu
- ^{240}Pu
- ^{137}Cs
- ^{90}Sr
- ^{3}H
- ^{238}U.

Note that a complete radionuclide analysis of the B Plant waste streams is not available. Thus, it is possible that additional radionuclides were disposed of to B Plant Aggregate Area waste management units that are not included in the waste inventories.

Nonradioactive chemicals reportedly released into B Plant Aggregate Area waste management units in large quantities include nitric acid, nitrates, sodium, phosphate, sulfate, tributyl phosphate and ammonium nitrate.

4.2.4.3 Mobility. Since most wastes at the B Plant Aggregate Area were released directly to subsurface soils via injection, infiltration, or burial, the mobility of the wastes in the subsurface will determine the potential for future exposures. The mobility of the contaminants listed in Table 4-24 varies widely and depends on site-specific factors as well as the intrinsic properties of the contaminant. Much of the site-specific information needed to characterize mobility is not available and will need to be obtained during future field investigations. However, it is possible to make general statements about the relative mobility of the candidate contaminants of concern.

4.2.4.3.1 Transport to the Subsurface. The mobility of radionuclides and other inorganic elements in groundwater depends on the chemical form and charge of the element or molecule, which in turn depends on site-related factors such as the pH, oxidation-reduction state, and ionic composition of the groundwater. Cationic species (e.g., Cd^{2+}, Pu^{4+}) generally are retarded in their migration relative to groundwater to a greater extent than anionic species such as nitrate (NO_3^-). The presence in groundwater of complexing or chelating agents can increase the mobility of metals by forming neutral or negatively charged compounds.

The chemical properties of radionuclides are essentially identical to the nonradioactive form of the element; thus, discussions of the chemical properties affecting the transport of contaminants can apply to both radionuclides and nonradioactive chemicals.

A soil-water distribution coefficient (K_d) can be used to predict mobility of inorganic chemicals in the subsurface. Table 4-23 presents a summary of soil-water distribution coefficients (K_d) that have been developed for many of the inorganic chemicals of concern at the B Plant Aggregate Area. As discussed above, the pH and ionic strength of the leaching medium has an impact on the absorption of inorganics to soil; thus, the listed K_ds are valid only for a limited range of pH and waste composition. In addition, soil sorption of inorganics is highly dependent on the mineral composition of the soil, the ionic composition of the soil pore water, and other site-specific factors. Thus, a high degree of uncertainty is involved with use of K_ds that have not been verified by experimentation with site soils.

Serne and Wood (1990) recommended K_ds for use with Hanford waste assessments for a limited number of important radionuclides (Am, Cs, Co, I, Pu, Ru, Sr, and tritium) based on soil column or batch desorption studies, and have proposed conservative average values for a more extensive list of elements based on a review of the literature. An assumed retardation of <1 is recommended for Am, Cs, Pu, and Sr under acidic conditions.

Strenge and Peterson (1989) developed default K_ds for a large number of elements for use in the Multimedia Environmental Pollution Assessment System (MEPAS), a computerized waste management unit evaluation system. The K_ds were based on findings in the scientific literature, and include non-site-specific as well as Hanford Site values. Values are provided for nine sets of environmental conditions: three ranges of waste pH and three ranges of soil adsorbent material (sum of percent clay, organic material, and metal hydrous oxides). The values presented in Table 4-23 are for conditions of neutral waste pH and less than 10% adsorbent material, which is likely to be most representative of Hanford Site soils.

The mobility of inorganic species in soil can be divided roughly into three classes, using site-specific values (Serne and Wood 1990) where available and generic values otherwise: highly mobile ($K_d<5$), moderately mobile ($5<K_d<100$), and low mobility ($K_d>100$). Table 4-24 lists the class ranking for each of the inorganic contaminants of concern. The ranking presented in this table is intended to provide a qualitative indication of general mobility characteristics. Actual mobility of specific contaminants will be influenced by their valence state and ligands. Specific mobilities will be determined in future site investigations and will address these potential influences.

The tendency of organic compounds to adsorb to the organic fraction of soils is indicated by the soil organic matter partition coefficient, K_{oc}. Partition coefficients for the organic chemicals of concern at the B Plant Aggregate Area are listed in Table 4-25. Chemicals with low K_{oc} values are weakly absorbed by soils and will tend to migrate in the subsurface, although their rate of travel will be retarded somewhat relative to the pore water or groundwater flow. Soils at the Hanford Site have very little organic carbon content and thus sorption to the inorganic fraction of soils may dominate over sorption to soil organic matter.

4.2.4.3.2 Transport to Air. Transport between soils and air can occur either by fugitive dust emissions or volatilization. Chemicals subject to transport via airborne dust dispersion are those that are non-volatile and persistent on the soil surface, including most radionuclides and inorganics, and some organics such as creosote and coal tar.

Chemicals subject to volatilization are mostly organic compounds; however, some of the radionuclides detected at the site are subject to evaporation and could be lost from shallow soils to the ambient air. The most important species in this category are ^{14}C, ^{3}H, and ^{129}I.

The tendency of an organic compound to volatilize can be predicted from its Henry's Law Constant, K_h, a measured or calculated parameter with units of atmospheres per cubic meter per mole of chemical. Henry's Law Constants of the organic candidate contaminants of concern are presented in Table 4-27. Compounds with a K_h greater than about 10^{-3} will be lost rapidly to the atmosphere from surface water and shallow soils. Organic contaminants of concern that fall into this class include:

- Carbon tetrachloride
- Chloroform
- Methylene chloride
- PCBs
- Toluene
- Tributyl phosphate
- 1,1,1-Trichloroethane.

4.2.4.4 Persistence. Once released to environmental media, the concentration of a contaminant may decrease because of biological or chemical transformation, radioactive decay, or the intermediate transfer processes discussed above that remove the chemical from the medium (e.g., volatilization to air). Radiological, chemical, and biological decay processes affecting the persistence of the B Plant Aggregate Area contaminants of concern are discussed below.

The persistence of radionuclides depends primarily on their half-lives. A comparison of the half-lives and specific activities for most radionuclide contaminants of concern for B Plant is presented in Table 4-26. The specific activity is the decay rate per unit mass, and is inversely proportional to the half-life of the radionuclide. Half-lives for the radionuclides listed in Table 4-26 range from seconds to over one billion years. Also listed are the radiation emissions of primary concern for the radionuclide. Note that radionuclides often emit multiple types of radiation and the daughter products of these decays are often themselves radioactive.

Decay will occur during transport (e.g., through the vadose zone to the aquifer, through the aquifer) and may lead to significant reductions in levels ultimately reaching offsite areas (e.g., Columbia River). For direct exposures (e.g., to surface soils or air), the half-life of the radionuclide is of less importance, unless the half-life is so short that the radionuclide undergoes substantial decay between the time of disposal and release to the environment.

Nonradioactive inorganic chemicals detected at the site are generally persistent in the environment, although they may decline in concentration due to transport processes or change their chemical form due to chemical or biological reactions. Nitrate undergoes chemical and biological transformations that may lead to its loss to the atmosphere (as N_2) or incorporation into living organisms, depending on the oxidation-reduction environment and microbiological communities present in the medium.

Biotransformation rates for organics vary widely and are highly dependent on site-specific factors such as soil moisture, oxidation-reduction conditions, and the presence of nutrients and of organisms capable of degrading the compound. Ketones, such as acetone and methyl ethyl ketone, are easily degraded by microorganisms in soil and thus would tend not to persist. Chlorinated solvents (e.g., carbon tetrachloride) may undergo slow biotransformation in the subsurface under anoxic conditions. Volatile aromatics such as toluene are generally intermediate in their biodegradability.

4.2.4.5 Toxicity. Contaminants may be of potential concern for impacts to human health if they are known or suspected to have carcinogenic properties, or if they have adverse noncarcinogenic human health effects. The toxicity characteristics of the chemicals detected at the operable unit are summarized below. As discussed in preceding sections, existing data are too general and do not adequately evaluate ecological risks. This data gap is discussed further in Sections 5.0 and 8.0.

4.2.4.5.1 Radionuclides. All radionuclides are classified by EPA as known human carcinogens based on their property of emitting ionizing radiation and on the evidence provided by epidemiological studies of radiation-induced cancers in humans. Non-carcinogenic health effects associated with radiation exposure include genetic and teratogenic effects; however, these effects generally occur at higher exposure levels than those required to induce cancer. Thus, the carcinogenic effect of radionuclides is the primary identified health concern for these chemicals (EPA 1989a).

Risks associated with radionuclides differ for various routes of exposure depending on the type of ionizing radiation emitted. Nuclides that emit alpha or beta particles are hazardous primarily if the materials are inhaled or ingested, since these particles expend their energy within a short distance after penetrating body tissues. Gamma-emitting radioisotopes, which deposit energy over much larger distances, are of concern as both external and internal hazards. A fourth mode of radioactive decay, neutron emission, is generally not of major health concern, since this mode of decay is much less frequent than other decay processes. In addition to the mode of radioactive decay, the degree of hazard from a particular radionuclide depends on the rate at which particles or gamma radiation are released from the material, the degree to which it may concentrate or accumulate in organs of the body following intake, and the length of time that is retained in that organ.

To illustrate their relative significance, excess cancer risks for exposure to the primary radionuclide contaminants of concern by inhaling air, drinking water, ingesting soil, and by external irradiation are shown in Table 4-27. These values represent the increase in probability of cancer to an individual exposed for a lifetime to a radionuclide at a level of 1 pCi/m^3 in air, 1 pCi/L in drinking water, 1 pCi/g in ingested soil, or to external radiation from soil having a radionuclide content of 1 pCi/g (EPA 1991b).

Slope factors are used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen. The Slope Factor is defined by the EPA (EPA 1989) as a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. For those radionuclides without EPA slope factors, the *Hanford Baseline Risk Assessment Methodology* (DOE/RL 1992b) will be consulted. This document proposes to consult the EPA Office of Radiation Programs to request the development of a slope factor or to use the dose conversion factors developed by the International Commission on Radiological Protection to calculate a risk value. In any event, the values shown in Table 4-27 are provided for perspective only, and any Hanford site risk assessments will be performed in accordance with the *Hanford Baseline Risk Assessment Methodology* document (DOE/RL 1992b) which includes the guidance established in the *Risk Assessment Guidance for Superfund* (EPA 1989a) and the EPA Region 10 *Supplemental Risk Assessment Guidance for Superfund* (EPA 1991a).

The unit risk factors for different radionuclides are roughly proportional to their specific activities, but also incorporate factors to account for distribution of each radionuclide within various body organs, the type of radiation emitted, and the length of time that the nuclide is retained in the organ of interest.

Based on the factors listed in Table 4-27, the highest risk for exposure to 1 pCi/m^3 in air is from plutonium, americium and uranium isotopes, which are alpha emitters. Among the radionuclide contaminants of concern for the B Plant Aggregate Area, the highest risks from ingestion of soil at 1 pCi/g are for ^{227}Ac, ^{241}Am, ^{243}Am, ^{238}Pu, ^{244}Cm, ^{134}Cs, ^{129}I, ^{237}Np, ^{231}Pa, ^{210}Pb, ^{210}Po, ^{223}Ra, ^{225}Ra, ^{226}Ra, ^{228}Ra, ^{229}Th, and the uranium isotopes. The primary gamma-emitters are ^{214}Bi, ^{60}Co, ^{134}Cs, ^{137m}Ba, ^{152}Eu, ^{154}Eu, and ^{214}Pb.

The standard EPA risk assessment methodology assumes that the probability of a carcinogenic effect increases linearly with dose at low dose levels, i.e., there is no threshold for carcinogenic response. The EPA methodology also assumes that the combined effect of exposure to multiple carcinogens is additive without regard to target organ or cancer mechanism.

4.2.4.5.2 Hazardous Chemicals. Carcinogenic and non-carcinogenic health effects associated with chemicals anticipated at the aggregate area are summarized in Table 4-28.

The EPA has not derived toxicity criteria for many of the chemicals suspected of being present or detected at the B Plant Aggregate Area. Many of the chemicals that lack toxicity criteria have negligible toxicity or are necessary nutrients in the human diet.

Several of the chemicals have known toxic effects but no toxicity criterion is presently available. In some instances the criteria have been withdrawn by EPA pending review of the toxicological data and will be reissued at a future date. Chemicals with known toxicity for which toxicity factors are presently not available include lead, kerosene, tributyl phosphate, and uranium.

4.2.4.6 Bioaccumulation potential. Contaminants may be of concern for exposure if they have a tendency to accumulate in plant or animal tissues at levels higher than those in the surrounding medium (bioaccumulation) or if their levels increase at higher trophic levels in the food chain (biomagnification). Contaminants may be bioaccumulated because of element-specific uptake mechanisms (e.g., incorporation of strontium into bone) or by passive partitioning into body tissues (e.g., concentration of organic chemicals in fatty tissues).

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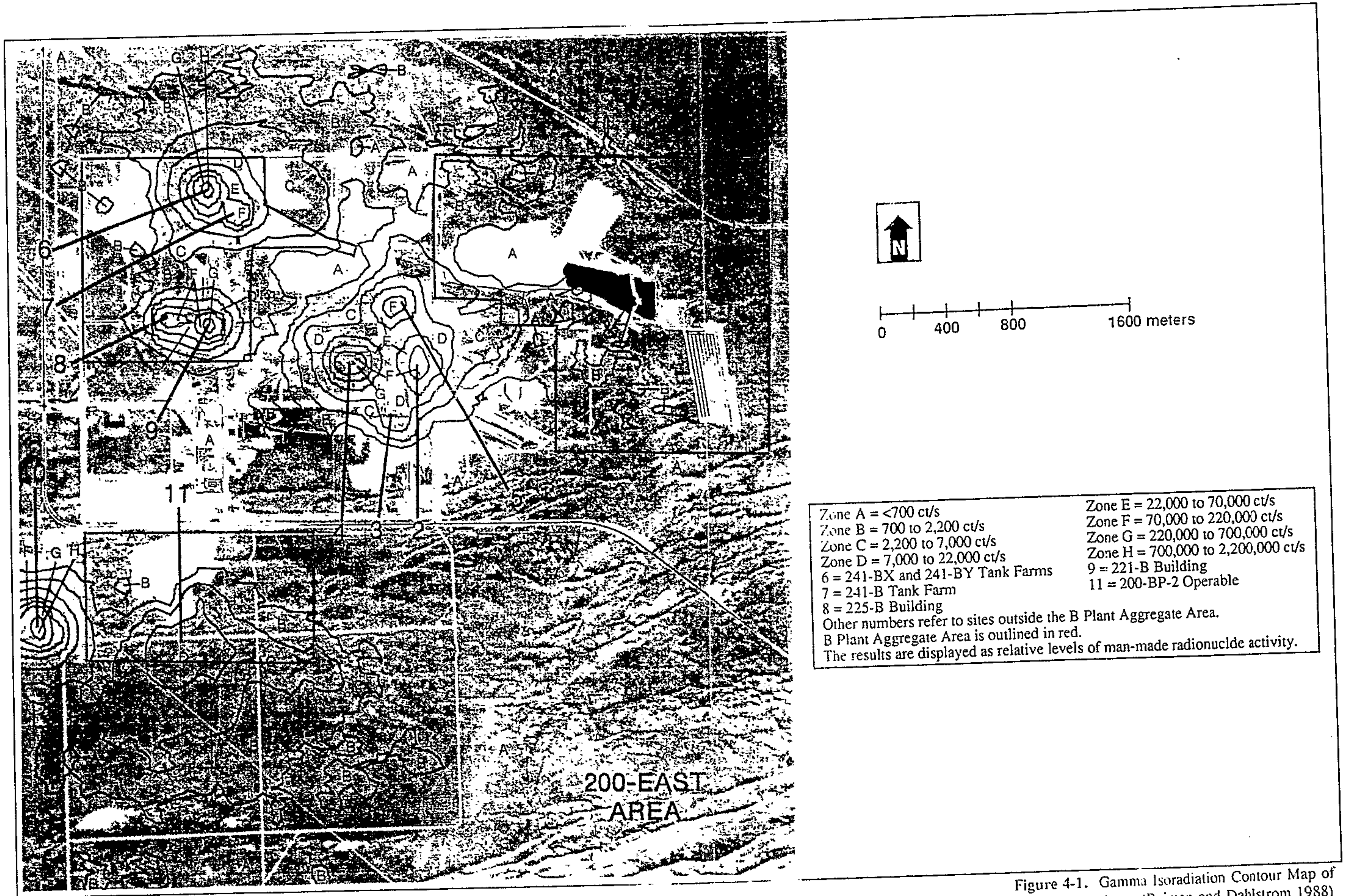

Figure 4-1. Gamma Isoradiation Contour Map of the 200 East Area. (Reiman and Dahlstrom 1988)

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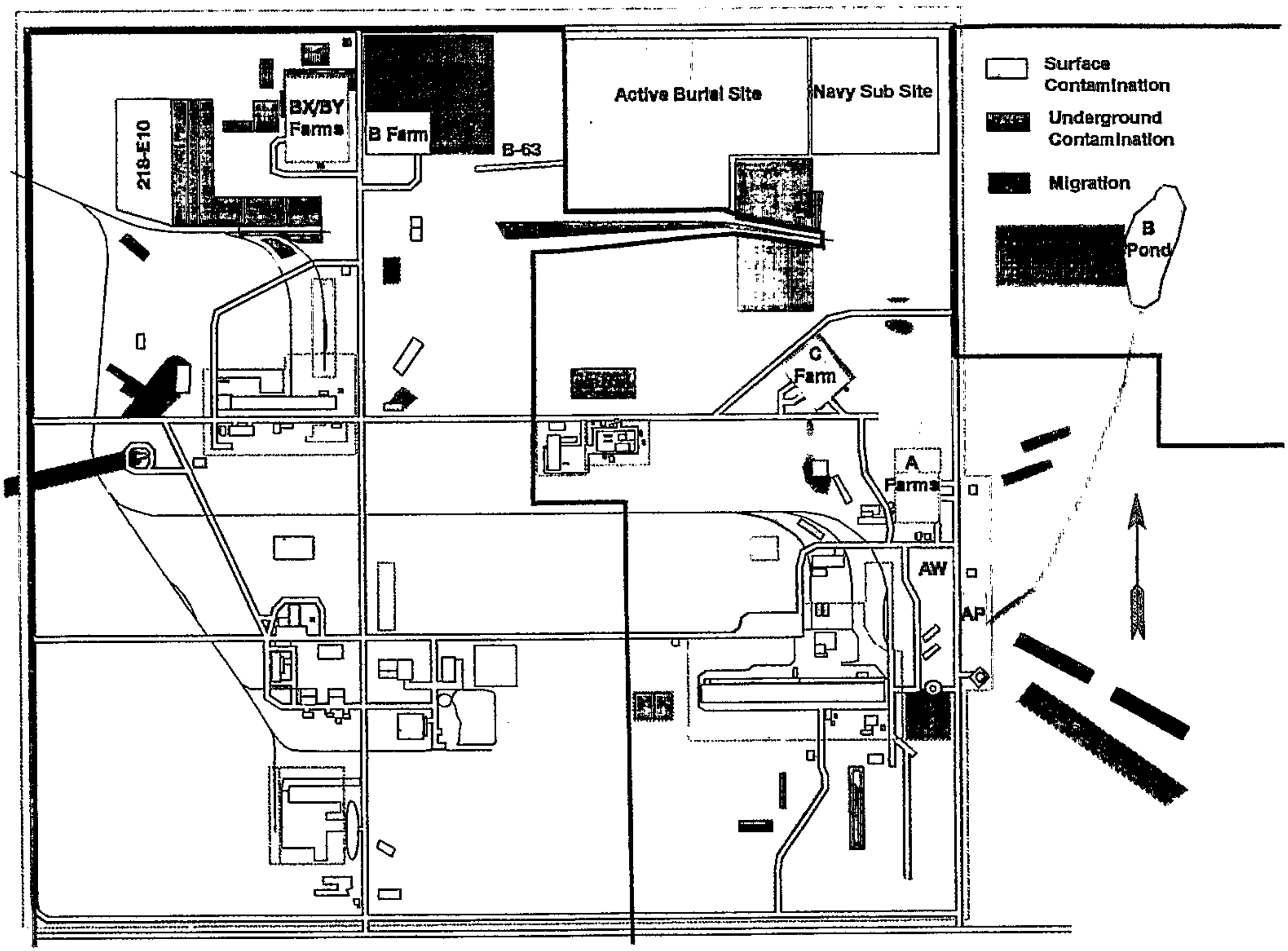

B Plant Aggregate Area is outlined in red.

Figure 4-2. Surface, Underground, and Migrating Map of the 200 East Area. (Huckfeldt 1991b)

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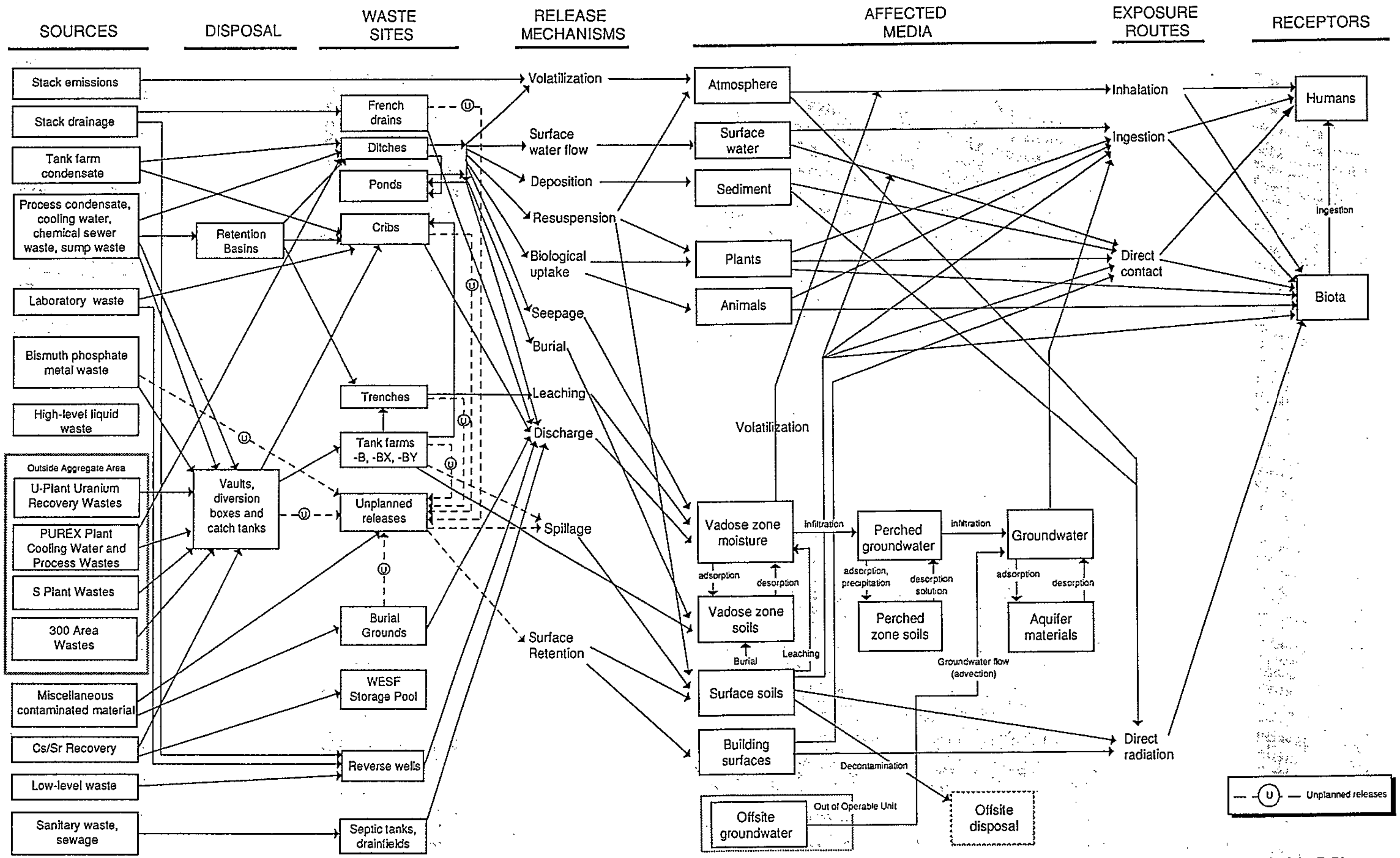

Figure 4-3. Conceptual Model of the B Plant Aggregate Area.

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Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
Plants, Buildings, and Storage Areas									
2703-E Hazardous Waste Staging Area	C	–	–	–	–	–	–	–	–
2704-E Hazardous Waste Staging Area	C	–	–	–	–	–	–	–	–
2715-EA Hazardous Waste Staging Area	C	–	–	–	–	–	–	–	–
226-B Hazardous Waste Staging Facility	C	–	–	–	–	–	–	–	–
Tanks and Vaults									
241-B-101 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-102 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-103 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-104 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-105 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-106 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-107 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-108 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-109 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-110 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-111 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-112 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
241-B-201 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-202 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-203 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-204 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-101 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-102 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-103 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-104 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-105 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-106 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-107 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-108 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-109 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-110 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-111 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BY-112 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-101 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-102 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 3 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
241-BX-103 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-104 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-105 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-106 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-107 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-108 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-109 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-110 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-111 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-BX-112 Single-Shell Tank	C, R	–	–	–	–	–	–	–	–
241-B-301B Catch Tank	–	–	–	–	–	–	–	–	–
241-B-302B Catch Tank	–	–	–	–	–	–	–	–	–
241-BX-302A Catch Tank	–	–	–	–	–	–	–	–	–
241-BX-302B Catch Tank	–	–	–	–	–	–	–	–	–
241-BX-302C Catch Tank	–	–	–	–	–	–	–	–	–
241-ER-311 Catch Tank	–	–	–	–	–	–	–	–	–
241-B-361 Settling Tank	–	–	–	–	–	–	–	–	–
244-BXR Receiving Vault	–	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
270-E Cond. Neut. Tank	–	–	–	–	–	–	–	–	–
Cribs and Drains									
216-B-7A Crib	C,R	–	–	–	–	–	–	R	–
216-B-7B Crib	C,R	–	–	–	–	–	–	R	–
216-B-8TF Crib/Tile Field	C,R	–	–	–	–	–	–	R	–
216-B-9TF Crib/Tile Field	C,R	–	–	–	–	–	–	R	–
216-B-10A Crib	C,R	–	–	–	–	–	–	R	–
216-B-10B Crib	C,R	–	–	–	–	–	–	R	–
216-B-12 Crib	C,R	–	–	–	–	–	R	R	–
216-B-14 Crib	C,R	–	–	–	–	–	–	R	–
216-B-15 Crib	C,R	–	–	–	–	–	–	R	–
216-B-16 Crib	C,R	–	–	–	–	–	–	R	–
216-B-17 Crib	C,R	–	–	–	–	–	–	R	–
216-B-18 Crib	C,R	–	–	–	–	–	–	R	–
216-B-19 Crib	C,R	–	–	–	–	–	–	R	–
216-B-43 Crib	C,R	–	–	–	–	–	–	R	–
216-B-44 Crib	C,R	–	–	–	–	–	–	R	–
216-B-45 Crib	C,R	–	–	–	–	–	–	R	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
216-B-46 Crib	C,R	--	--	--	--	--	--	R	--
216-B-47 Crib	C,R	--	--	--	--	--	--	R	--
216-B-48 Crib	C,R	--	--	--	--	--	--	R	--
216-B-49 Crib	C,R	--	--	--	--	--	--	R	--
216-B-50 Crib	C,R	--	--	--	--	--	--	R	--
216-B-55 Crib	C,R	--	--	R	--	--	R	R	--
216-B-56 Crib	--	--	--	--	--	--	--	R	--
216-B-57 Crib	C,R	--	--	--	--	--	--	R	--
216-B-60 Crib	--	--	--	--	--	--	--	--	--
216-B-61 Crib	--	--	--	--	--	--	--	--	--
216-B-62 Crib	R	--	--	R	--	--	R	R	--
CTF North of 2703-E	--	--	--	--	--	--	--	--	--
216-B-13 French Drain	--	--	--	--	--	--	--	R	--
216-B-51 French Drain	--	--	--	--	--	--	--	R	--
Reverse Wells									
216-B-4 Reverse Wells	C	--	--	--	--	--	--	R	--
216-B-5 Reverse Wells	C	--	--	R	R	--	--	R	--
216-B-6 Reverse Wells	C	--	--	--	--	--	--	R	--

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
216-B-11A Reverse Well	C,R	–	–	–	–	–	–	R	–
216-B-11B Reverse Well	C,R	–	–	–	–	–	–	R	–
Ponds, Ditches, and Trenches									
216-B-3 Pond	R	–	R	R	R	–	–	R	–
216-B-3A Pond	–	–	–	–	R	–	–	–	–
216-B-3B Pond	–	–	–	–	–	–	–	–	–
216-B-3C Pond	–	–	R	R	R	–	–	–	–
216-A-25 Pond	R	–	–	–	–	–	R	R	–
216-E-28 Contingency Pond	–	–	–	–	–	–	–	–	–
216-N-8 Pond	–	–	R	R	R	–	R	R	–
2101-M Pond	–	–	–	–	C,R	C,R	–	–	–
216-B-2-1 Ditch	–	–	–	–	–	–	–	R	–
216-B-2-2 Ditch	–	–	–	–	–	–	–	R	–
216-B-2-3 Ditch	–	–	–	R	–	–	–	R	–
216-B-3-1 Ditch	–	–	–	–	–	–	–	R	–
216-B-3-2 Ditch	–	–	–	–	–	–	–	R	–
216-B-3-3 Ditch	–	–	R	–	R	–	R	R	–
216-B-20 Trench	C,R	–	–	–	–	–	–	R	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 7 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
216-B-21 Trench	C,R	--	--	--	--	--	--	R	--
216-B-22 Trench	C,R	--	--	--	--	--	--	R	--
216-B-23 Trench	C,R	--	--	--	--	--	--	R	--
216-B-24 Trench	C,R	--	--	--	--	--	--	R	--
216-B-25 Trench	C,R	--	--	--	--	--	--	R	--
216-B-26 Trench	C,R	--	--	--	--	--	--	R	--
216-B-27 Trench	C,R	--	--	--	--	--	--	R	--
216-B-28 Trench	C,R	--	--	--	--	--	--	R	--
216-B-29 Trench	C,R	--	--	--	--	--	--	R	--
216-B-30 Trench	C,R	--	--	--	--	--	--	R	--
216-B-31 Trench	C,R	--	--	--	--	--	--	R	--
216-B-32 Trench	C,R	--	--	--	--	--	--	R	--
216-B-33 Trench	C,R	--	--	--	--	--	--	R	--
216-B-34 Trench	C,R	--	--	--	--	--	--	R	--
216-B-35 Trench	C,R	--	--	--	--	--	--	R	--
216-B-36 Trench	C,R	--	--	--	--	--	--	R	--
216-B-37 Trench	C,R	--	--	--	--	--	--	R	--
216-B-38 Trench	C,R	--	--	--	--	--	--	R	--

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
216-B-39 Trench	C,R	–	–	–	–	–	–	R	–
216-B-40 Trench	C,R	–	–	–	–	–	–	R	–
216-B-41 Trench	C,R	–	–	–	–	–	–	R	–
216-B-42 Trench	C,R	–	–	–	–	–	–	R	–
216-B-52 Trench	C,R	–	–	–	–	–	–	R	–
216-B-53A Trench	C,R	–	–	–	–	–	–	R	–
216-B-53B Trench	C,R	–	–	–	–	–	–	R	–
216-B-54 Trench	C,R	–	–	–	–	–	–	R	–
216-B-58 Trench	C,R	–	–	–	–	–	–	–	–
216-B-63 Trench	–	–	R	R	R	–	R	–	–
Septic Tanks and Associated Drain Fields									
2607-E1 Septic Tank	–	–	–	–	–	–	–	–	–
2607-E2 Septic Tank	–	–	–	–	–	–	–	–	–
2607-E3 Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-E4 Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-E7B Septic Tank	–	–	–	–	–	–	–	–	–
2607-E8 Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-E9 Septic Tank	–	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 9 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
2607-E11 Septic Tank	–	–	–	–	–	–	–	–	–
2607-EB Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-EH Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-EK Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-EM Septic Tank	–	–	–	–	–	–	–	–	–
2607-EN Septic Tank	–	–	–	–	–	–	–	–	–
2607-EO Septic Tank	–	–	–	–	–	–	–	–	–
2607-EP Septic Tank	–	–	–	–	–	–	–	–	–
2607-EQ Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
2607-ER Septic Tank	–	–	–	–	–	–	–	–	–
2607-GF Septic Tank/Drain Field	–	–	–	–	–	–	–	–	–
Transfer Facilities, Diversion Boxes, and Pipelines									
241-B-151 Diversion Box	–	–	–	–	–	–	–	–	–
241-B-152 Diversion Box	–	–	–	–	–	–	–	–	–
241-B-153 Diversion Box	–	–	–	–	–	–	–	–	–
241-B-154 Diversion Box	–	–	–	–	–	–	–	–	–
241-B-252 Diversion Box	–	–	–	–	–	–	–	–	–
241-BR-152 Diversion Box	–	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
241-BX-153 Diversion Box	--	--	--	--	--	--	--	--	--
241-BX-154 Diversion Box	--	--	--	--	--	--	--	--	--
241-BX-155 Diversion Box	--	--	--	--	--	--	--	--	--
241-BXR-151 Diversion Box	--	--	--	--	--	--	--	--	--
241-BXR-152 Diversion Box	--	--	--	--	--	--	--	--	--
241-BXR-153 Diversion Box	--	--	--	--	--	--	--	--	--
241-BYR-152 Diversion Box	--	--	--	--	--	--	--	--	--
241-BYR-153 Diversion Box	--	--	--	--	--	--	--	--	--
241-BYR-154 Diversion Box	--	--	--	--	--	--	--	--	--
241-ER-151 Diversion Box	--	--	--	--	--	--	--	--	--
241-ER-152 Diversion Box	--	--	--	--	--	--	--	--	--
242-B-151 Diversion Box	--	--	--	--	--	--	--	--	--
Basins									
207-B Retention Basin	--	--	--	--	--	--	--	R	--
216-B-59B Retention Basin	R	--	--	--	--	--	--	R	--
216-B-64 Retention Basin	--	--	--	--	--	--	--	R	--
Burial Sites									
218-E-2 Burial Ground	R	--	--	--	--	--	--	R	--

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
218-E-2A Burial Ground	--	--	--	--	--	--	--	R	--
218-E-3 Burial Ground	--	--	--	--	--	--	--	--	--
218-E-4 Burial Ground	R	--	--	--	--	--	--	R	--
218-E-5 Burial Ground	R	--	--	--	--	--	--	R	--
218-E-5A Burial Ground	R	--	--	--	--	--	--	R	--
218-E-6 Burial Ground	--	--	--	--	--	--	--	--	--
218-E-7 Burial Ground	R	--	--	--	--	--	--	R	--
218-E-9 Burial Ground	--	--	--	--	--	--	--	R	--
218-E-10 Burial Ground	--	--	--	--	--	--	--	--	--
200 Area Construction Pit	--	--	--	--	--	--	--	--	--
200-E Powerhouse Ash Pit	--	--	--	--	--	--	--	--	--
Unplanned Release									
UN-200-E-1	--	--	--	--	--	--	--	--	--
UN-200-E-2	--	--	--	--	--	--	--	--	--
UN-200-E-3	--	--	--	--	--	--	--	--	--
UN-200-E-7	--	--	--	--	--	--	--	--	--
UN-200-E-9	--	--	--	--	--	--	--	--	--
UN-200-E-14	--	--	--	--	--	--	--	--	--

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 12 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
UN-200-E-41	R	--	--	--	--	--	--	--	--
UN-200-E-43	--	--	--	--	--	--	--	--	--
UN-200-E-44	--	--	--	--	--	--	--	--	--
UN-200-E-45	--	--	--	--	--	--	--	--	--
UN-200-E-52	--	--	--	--	--	--	--	--	--
UN-200-E-54	--	--	--	--	--	--	--	--	--
UN-200-E-55	--	--	--	--	--	--	--	--	--
UN-200-E-61	--	--	--	--	--	--	--	--	--
UN-200-E-63	--	--	--	--	--	--	--	--	--
UN-200-E-64	R	--	--	--	--	--	--	--	--
UN-200-E-69	--	--	--	--	--	--	--	--	--
UN-200-E-76	R	--	--	--	--	--	--	--	--
UN-200-E-79	--	--	--	--	--	--	--	--	--
UN-200-E-80	--	--	--	--	--	--	--	--	--
UN-200-E-83	R[a/]	--	--	--	--	--	--	--	--
UN-200-E-85	C,R	--	--	--	--	--	--	--	--
UN-200-E-87	R	--	--	--	--	--	--	R	--
UN-200-E-89	--	--	--	--	--	--	--	R	--

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
UN-200-E-90	–	–	–	–	–	–	–	–	–
UN-200-E-92	–	–	–	–	–	–	–	–	–
UN-200-E-95	–	–	–	–	–	–	–	R	–
UN-200-E-101	–	–	–	–	–	–	–	R	–
UN-200-E-103	–	–	–	–	–	–	–	–	–
UN-200-E-105	–	–	–	–	–	–	–	–	–
UN-200-E-109	C	–	–	–	–	–	–	–	–
UN-200-E-110	–	–	–	–	–	–	–	–	–
UN-200-E-112	–	–	–	–	–	–	–	–	–
UN-200-E-140	C	–	–	–	–	–	–	–	–
UPR-200-E-4	–	–	–	–	–	–	–	–	–
UPR-200-E-5	R	–	–	–	–	–	–	–	–
UPR-200-E-6	–	–	–	–	–	–	–	–	–
UPR-200-E-32	R	–	–	–	–	–	–	R	–
UPR-200-E-34	–	–	–	–	–	–	–	–	–
UPR-200-E-38	–	–	–	–	–	–	–	–	–
UPR-200-E-51	C	–	–	–	–	–	–	–	–
UPR-200-E-73	–	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 14 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
UPR-200-E-74	–	–	–	–	–	–	–	–	–
UPR-200-E-75	–	–	–	–	–	–	–	–	–
UPR-200-E-77	–	–	–	–	–	–	–	R	–
UPR-200-E-78	–	–	–	–	–	–	–	R	–
UPR-200-E-84	–	–	–	–	–	–	–	R	–
UPR-200-E-108	–	–	–	–	–	–	–	–	–
UPR-200-E-116	C,R	–	–	–	–	–	–	–	–
UPR-200-E-127	R	–	–	–	–	–	–	–	–
UPR-200-E-128	R	–	–	–	–	–	–	–	–
UPR-200-E-129	R	–	–	–	–	–	–	–	–
UPR-200-E-130	C	–	–	–	–	–	–	–	–
UPR-200-E-131	R	–	–	–	–	–	–	–	–
UPR-200-E-132	–	–	–	–	–	–	–	–	–
UPR-200-E-133	R	–	–	–	–	–	–	–	–
UPR-200-E-134	–	–	–	–	–	–	–	–	–

Table 4-1. Types of Data for the B Plant Aggregate Area Waste Management Units. Page 15 of 15

Waste Management Unit	Inventory	Air Sampling Data	Biota Sampling Data	Water Sample Data	Surface Soil/ Sediment Data	Subsurface Vapor/ Soil Sampling Data	Radiation Monitoring Data	Surface Radiological Survey	Borehole Geophysics
UPR-200-E-135	--	--	--	--	--	--	--	--	--
UPR-200-E-138	--	--	--	--	--	--	--	--	--

[a] DOE/RL 1991a
Other information from WIDS and HISS databases.
C = Chemical-Related Data
R = Radionuclide-Related Data

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
Plants, Buildings, and Storage Areas						
2703-E Hazardous Waste Staging Area	--	--	--	--	--	For the temporary storage of liquid hazardous materials
2704-E Hazardous Waste Staging Area	--	--	--	--	--	For the temporary storage of hazardous materials
2715-EA Hazardous Waste Staging Area	--	--	--	--	--	For the temporary storage of hazardous materials
226-B Hazardous Waste Staging Facility	s	s	--	--	--	For the temporary storage of hazardous materials
224-B Concentration Facility	s	s	--	--	--	Contains radioactive equipment/concrete
Tanks and Vaults						
241-B-101 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-102 Single-Shell Tank	--	--	--	--	--	Associated with UPR-200-E-108
241-B-103 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-105 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-106 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-107 Single-Shell Tank	--	s	--	--	s	No reported release (See UPR-200-E-127)
241-B-108 Single-Shell Tank	--	--	--	--	--	No reported release

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-B-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-110 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-128
241-B-111 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-112 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-201 Single-Shell Tank	--	s	--	--	s	No reported release (See UPR-200-E-129)
241-B-202 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-203 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-130
241-B-204 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-101 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-102 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-103 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-134
241-BY-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-105 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-106 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-107 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-108 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-135
241-BY-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-110 Single-Shell Tank	--	--	--	--	--	No reported release

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-BY-111 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-112 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-101 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-102 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-131, UPR-200-E-132, and UPR-200-E-5
241-BX-103 Single-Shell Tank	--	k	--	--	s	No reported release
241-BX-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-105 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-106 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-107 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-108 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-110 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-111 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-112 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-301B Catch Tank	--	--	--	--	--	No reported release
241-B-302B Catch Tank	--	--	--	--	--	No reported release
241-BX-302A Catch Tank	--	--	--	--	--	No reported release
241-BX-302B Catch Tank	--	--	--	--	--	No reported release

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-BX-302C Catch Tank	--	--	--	--	--	No reported release
241-ER-311 Catch Tank	--	k	--	--	--	Associated with UPR-200-E-84
241-B-361 Settling Tank	--	--	--	--	--	No reported release
270-E Condensate Neutralization Tank	--	s	--	--	--	High priority for decommissioning
244-BXR Receiving Vault	--	--	--	--	--	No reported release
Cribs and Drains						
216-B-7A Crib	--	k	--	--	s	--
216-B-7B Crib	--	k	--	--	s	--
216-B-10A Crib	--	--	--	--	s	--
216-B-10B Crib	--	--	--	--	s	--
216-B-12 Crib	s	s	--	s	s	--
216-B-14 Crib	--	s	--	--	s	--
216-B-15 Crib	--	s	--	--	s	--
216-B-16 Crib	--	s	--	--	s	--
216-B-17 Crib	--	s	--	--	s	--
216-B-18 Crib	--	s	--	--	s	Cave-in occurred in 1974; filled in with gravel
216-B-19 Crib	--	s	--	--	s	--
216-B-43 Crib	--	k,r?	--	s	s	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-44 Crib	--	k,r?	--	s	s	--
216-B-45 Crib	--	k,r?	--	s	s	--
216-B-46 Crib	--	k,r?	--	s	s	--
216-B-47 Crib	--	k,r?	--	s	s	--
216-B-48 Crib	--	k,r?	--	s	s	--
216-B-49 Crib	--	k,r?	--	s	s	--
216-B-50 Crib	--	k,r?	--	s	s	--
216-B-55 Crib	--	--	--	R	s	--
216-B-56 Crib	--	--	--	--	s	Unit never used; pipeline not installed
216-B-57 Crib	--	k	--	--	s	--
216-B-60 Crib	--	--	--	--	--	--
216-B-61 Crib	--	--	--	--	--	Unit never used
216-B-62 Crib	--	--	--	--	s	--
216-B-8TF Crib/Tile Field	--	k	--	k	s	--
216-B-9TF Crib/Tile Field	--	k	--	s	s	--
216-B-13 French Drain	--	--	--	--	s	--
216-B-51 French Drain	--	--	--	--	s	--
Chemical Tile Field North of 2703-E	--	--	--	--	--	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
Reverse Wells						
216-B-4 Reverse Well	--	--	--	--	s	--
216-B-5 Reverse Well	--	k	--	--	k	--
216-B-6 Reverse Well	--	--	--	--	s	--
216-B-11A Reverse Well	s	k	s	s	s	--
216-B-11B Reverse Well	s	k	s	s	s	--
Ponds, Ditches, and Trenches						
216-B-3 Pond	--	s	s	s	s	Associated with UPR-200-E-32, UPR-200-E-34, and UPR-200-E-138
216-B-3A Pond	--	--	--	--	--	--
216-B-3B Pond	--	--	--	--	--	--
216-B-3C Pond	--	--	--	--	--	--
216-A-25 Pond	--	s,r?	s	s	s	Associated with UPR-200-E-34
216-E-28 Contingency Pond	--	--	--	--	--	--
216-N-8 Pond	--	--	--	--	--	--
2101-M Pond	--	--	--	--	--	--
216-B-2-1 Ditch	s	k,r?	--	s,r?	k	Associated with UPR-200-E-34
216-B-2-2 Ditch	--	k	s	s	k	Associated with UPR-200-E-138
216-B-2-3 Ditch	--	s,r?	--	--	s	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-3-1 Ditch	--	k	--	k	s	Associated with UPR-200-E-34
216-B-3-2 Ditch	--	s	s	k	s	Associated with UPR-200-E-138
216-B-3-3 Ditch	--	k	s	s	--	Associated with UPR-200-E-51
216-B-20 Trench	--	--	--	--	s	--
216-B-21 Trench	--	--	--	--	s	--
216-B-22 Trench	--	--	--	--	s	--
216-B-23 Trench	--	--	--	--	s	--
216-B-24 Trench	--	--	--	--	s	--
216-B-25 Trench	--	--	--	--	s	--
216-B-26 Trench	--	--	--	--	s	--
216-B-27 Trench	--	--	--	--	s	--
216-B-28 Trench	--	--	--	--	s	--
216-B-29 Trench	--	--	--	--	s	--
216-B-30 Trench	--	--	--	--	s	--
216-B-31 Trench	--	--	--	--	s	--
216-B-32 Trench	--	--	--	--	s	--
216-B-33 Trench	--	--	--	--	s	--
216-B-34 Trench	--	--	--	--	s	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-35 Trench	--	--	--	--	s	--
216-B-36 Trench	--	--	--	--	s	--
216-B-37 Trench	--	--	--	--	s	--
216-B-38 Trench	--	--	--	--	s	--
216-B-39 Trench	--	--	--	--	s	--
216-B-40 Trench	--	--	--	--	s	--
216-B-41 Trench	--	--	--	--	s	--
216-B-42 Trench	--	--	--	--	s	--
216-B-52 Trench	--	--	--	s	s	--
216-B-53A Trench	--	--	--	s	s	--
216-B-53B Trench	--	--	--	--	s	--
216-B-54 Trench	--	--	--	--	s	--
216-B-58 Trench	--	--	--	--	s	--
216-B-63 Trench	--	k	--	s	s	--
Septic Drains and Associated Drain Fields						
2607-E1 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E2 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E3 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
2607-E4 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-E7B Septic Tank	--	--	--	--	--	No reported contaminants
2607-E8 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-E9 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E11 Septic Tank	--	--	--	--	--	No reported contaminants
2607-EB Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EH Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EK Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EM Septic Tank	--	--	--	--	--	No reported contaminants
2607-EN Septic Tank	--	--	--	--	--	No reported contaminants
2607-EO Septic Tank	--	--	--	--	--	No reported contaminants
2607-EP Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EQ Septic Tank	--	--	--	--	--	No reported contaminants
2607-ER Septic Tank	--	--	--	--	--	No reported contaminants
2607-GF Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
Transfer Facilities, Diversion Boxes, and Pipelines						
241-B-151 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-4 and UPR-200-E-73

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-B-152 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-74 and UPR-200-E-38
241-B-153 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-6 and UPR-200-E-75
241-B-154 Diversion Box	s	s	--	--	s	Associated with UPR-200-E-77 and UPR-200-E-45
241-B-252 Diversion Box	--	--	--	--	--	No reported release
241-BR-152 Diversion Box	--	--	--	--	--	No reported release
241-BX-153 Diversion Box	--	--	--	--	--	No reported release
241-BX-154 Diversion Box	--	--	--	--	--	No reported release
241-BX-155 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-78
241-BXR-151 Diversion Box	--	--	--	--	--	No reported release
241-BXR-152 Diversion Box	--	--	--	--	--	No reported release
241-BXR-153 Diversion Box	--	--	--	--	--	No reported release
241-BYR-152 Diversion Box	--	--	--	--	--	No reported release
241-BYR-153 Diversion Box	--	--	--	--	--	No reported release
241-BYR-154 Diversion Box	--	--	--	--	--	No reported release
241-ER-151 Diversion Box	--	--	--	--	--	No reported release
241-ER-152 Diversion Box	--	--	--	--	--	No reported release

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units. Page 11 of 15

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
242-B-151 Diversion Box	--	--	--	--	--	No reported release
			Basins			
207-B Retention Basin	--	k	--	--	--	Associated with UPR-200-E-32
216-B-59B Retention Basin	--	s	--	--	--	--
216-B-64 Retention Basin	--	k	--	--	--	Unit never used
			Burial Sites			
218-E-2 Burial Ground	--	s,r?	--	k	s	--
218-E-2A Burial Ground	--	s,r?	--	--	s	--
218-E-3 Burial Ground	--	--	--	--	--	Exhumed and released from radiation zone status
218-E-4 Burial Ground	--	s,r?	--	k	s	--
218-E-5 Burial Ground	--	s	--	k	s	--
218-E-5A Burial Ground	--	s,r?	--	k	s	--
218-E-6 Burial Ground	--	--	--	--	--	Exhumed and released from radiation zone status
218-E-7 Burial Ground	--	--	--	--	--	--
218-E-9 Burial Ground	--	s,r?	--	k	s	--
218-E-10 Burial Ground	--	--	--	s	s	--
200 Area Construction Pit	--	--	--	--	--	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
200-E Powerhouse Ash Pit	--	--	--	--	--	--
Unplanned Releases						
UN-200-E-1	--	s	--	--	s,r?	--
UN-200-E-2	--	s	--	--	k	--
UN-200-E-3	--	s	--	--	k	--
UN-200-E-7	--	--	--	--	k	--
UN-200-E-9	--	--	--	--	--	--
UN-200-E-14	--	k,r	--	--	--	--
UN-200-E-41	--	--	--	--	--	Waste line leakage contaminated the stairwell at the 271-B Building
UN-200-E-43	--	k	--	--	s	--
UN-200-E-44	--	s,r	--	--	--	--
UN-200-E-45	--	k,r?	--	--	k,r?	--
UN-200-E-52	--	k,r?	--	--	k,r?	--
UN-200-E-54	--	k,r?	--	--	--	--
UN-200-E-55	s	k,r?	--	--	--	--
UN-200-E-61	--	k,r	--	--	--	--
UN-200-E-63	--	k	--	k,r	--	--
UN-200-E-64	--	k	--	--	--	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UN-200-E-69	--	k	--	--	--	--
UN-200-E-76	--	k,r?	--	--	k,r?	--
UN-200-E-79	--	k,r?	--	--	s	--
UN-200-E-80	--	k,r?	--	--	k,r?	--
UN-200-E-83	--	k	--	s	--	--
UN-200-E-85	--	s	--	--	s	--
UN-200-E-87	s	k	--	s	--	--
UN-200-E-89	--	--	--	--	--	--
UN-200-E-90	s	s	--	--	s	--
UN-200-E-92	--	s,r	--	--	--	--
UN-200-E-95	--	k	--	--	--	--
UN-200-E-101	--	s	--	s	--	--
UN-200-E-103	--	s,r?	--	--	s,r?	--
UN-200-E-105	--	k,r?	--	--	s	Contaminated area covered with concrete
UN-200-E-109	--	k,r?	--	--	s	Stabilized with asphalt
UN-200-E-110	--	k	--	--	--	--
UN-200-E-112	--	k,r	--	--	--	--
UN-200-E-140	--	k,r	--	--	s,r	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UPR-200-E-4	--	k,r?	--	--	k,r?	--
UPR-200-E-5	--	k	--	--	k	--
UPR-200-E-6	--	k	--	--	s	--
UPR-200-E-32	--	k,r?	--	k,r?	s	--
UPR-200-E-34	--	k	s	--	s	--
UPR-200-E-38	--	k	--	--	s	--
UPR-200-E-51	--	--	--	--	--	51 kg of cadmium nitrate was released
UPR-200-E-73	--	s,r?	--	--	s	--
UPR-200-E-74	--	k,r?	--	--	--	--
UPR-200-E-75	--	s,r?	--	--	s	--
UPR-200-E-77	--	s,r?	--	--	s	--
UPR-200-E-78	--	k,r	--	--	--	--
UPR-200-E-84	--	k	--	--	--	--
UPR-200-E-108	--	k,r	--	--	--	--
UPR-200-E-116	--	k,r?	--	--	--	--
UPR-200-E-127	--	s	--	--	s	--
UPR-200-E-128	--	k,r?	--	--	k	Salt well installed; interstitial liquid removed
UPR-200-E-129	--	s	--	--	s	--

Table 4-2. Summary of Radionuclide Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units. Page 15 of 15

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UPR-200-E-130	--	s	--	--	--	--
UPR-200-E-131	--	k	--	--	s	--
UPR-200-E-132	--	k,r?	--	--	s	--
UPR-200-E-133	--	k,r?	--	--	s	--
UPR-200-E-134	--	s,r?	--	--	s	Salt well installed; interstitial liquid removed
UPR-200-E-135	--	s,r	--	--	s	Salt well installed
UPR-200-E-138	--	k,r?	--	--	s	--

Notes:
- s Suspected contamination, primarily based on WIDS (WHC 1991a) and other waste inventory data.
- k Known contamination based on chemical analytical data, WIDS (WHC 1991a), or other sources.
- r Complete remediation reported.
- r? Remediation attempted, effectiveness not documented.

A dashed line (--) indicates where no data are available.

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
Plants, Buildings, and Storage Areas						
2703-E Hazardous Waste Staging Area	s	s	--	--	--	For the temporary storage of liquid hazardous materials
2704-E Hazardous Waste Staging Area	--	s	--	--	--	For the temporary storage of hazardous materials
2715-EA Hazardous Waste Staging Area	s	s	--	--	--	For the temporary storage of waste paint and thinning solvents
226-B Hazardous Waste Staging Facility	--	--	--	--	--	For the temporary storage of hazardous materials
224-B Concentration Facility	--	--	--	--	--	Contains radioactive equipment/concrete
Tanks and Vaults						
241-B-101 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-102 Single-Shell Tank	--	--	--	--	--	Associated with UPR-200-E-108
241-B-103 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-105 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-106 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-107 Single-Shell Tank	--	s	--	--	s	No reported release (See UPR-200-E-127)
241-B-108 Single-Shell Tank	--	--	--	--	--	No reported release

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-B-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-110 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-128
241-B-111 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-112 Single-Shell Tank	--	s	--	--	s	No reported release
241-B-201 Single-Shell Tank	--	s	--	--	s	No reported release (See UPR-200-E-129)
241-B-202 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-203 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-130
241-B-204 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-101 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-102 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-103 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-134
241-BY-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-105 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-106 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-107 Single-Shell Tank	--	s	--	--	s	No reported release
241-BY-108 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-135
241-BY-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-110 Single-Shell Tank	--	--	--	--	--	No reported release

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-BY-111 Single-Shell Tank	--	--	--	--	--	No reported release
241-BY-112 Single-Shell Tank	--	--	--	--	--	Associated with UPR-200-E-116
241-BX-101 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-102 Single-Shell Tank	--	s	--	--	s	Associated with UPR-200-E-131, UPR-200-E-132, and UPR-200-E-5
241-BX-103 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-104 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-105 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-106 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-107 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-108 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-109 Single-Shell Tank	--	--	--	--	--	No reported release
241-BX-110 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-111 Single-Shell Tank	--	s	--	--	s	No reported release
241-BX-112 Single-Shell Tank	--	--	--	--	--	No reported release
241-B-301B Catch Tank	--	--	--	--	--	No reported release
241-B-302B Catch Tank	--	--	--	--	--	No reported release
241-BX-302A Catch Tank	--	--	--	--	--	No reported release
241-BX-302B Catch Tank	--	--	--	--	--	No reported release

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-BX-302C Catch Tank	--	--	--	--	--	No reported release
241-ER-311 Catch Tank	--	k	--	--	s	Associated with UPR-200-E-84
241-B-361 Settling Tank	--	s	--	--	--	No reported release
270-E Condensate Neutralization Tank	--	s	--	--	--	High priority for decommissioning
244-BXR Receiving Vault	--	--	--	--	--	No reported release
Cribs and Drains						
216-B-7A Crib	--	s	--	--	s	--
216-B-7B Crib	--	s	--	--	s	--
216-B-10A Crib	--	--	--	--	s	--
216-B-10B Crib	--	--	--	--	--	--
216-B-12 Crib	--	s	--	--	s	--
216-B-14 Crib	--	s	--	--	s	--
216-B-15 Crib	--	s	--	--	s	--
216-B-16 Crib	--	s	--	--	s	--
216-B-17 Crib	--	s	--	--	s	--
216-B-18 Crib	--	s	--	--	s	Cave-in occurred in 1974; filled in with gravel
216-B-19 Crib	--	s	--	--	s	--
216-B-43 Crib	--	s	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-44 Crib	--	s	--	--	s	--
216-B-45 Crib	--	s	--	--	s	--
216-B-46 Crib	--	s	--	--	s	--
216-B-47 Crib	--	s	--	--	s	--
216-B-48 Crib	--	s	--	--	s	--
216-B-49 Crib	--	s	--	--	s	--
216-B-50 Crib	--	s	--	--	s	--
216-B-55 Crib	--	s	--	--	s	--
216-B-56 Crib	--	--	--	--	--	Unit never used; pipeline not installed
216-B-57 Crib	--	s	--	--	s	--
216-B-60 Crib	--	--	--	--	--	--
216-B-61 Crib	--	--	--	--	--	Unit never used
216-B-62 Crib	--	--	--	--	--	--
216-B-8TF Crib/Tile Field	--	s	--	s	s	--
216-B-9TF Crib/Tile Field	--	--	--	--	--	--
216-B-13 French Drain	--	--	--	--	--	--
216-B-51 French Drain	--	--	--	--	--	--
Chemical Tile Field North of 2703-E	--	--	--	--	--	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
Reverse Wells						
216-B-4 Reverse Well	--	--	--	--	--	--
216-B-5 Reverse Well	--	s	--	--	s	--
216-B-6 Reverse Well	--	--	--	--	s	--
216-B-11A Reverse Well	--	s	--	--	s	--
216-B-11B Reverse Well	--	s	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
			Ponds, Ditches, and Trenches			
216-B-3 Pond	--	s	s	s	s	Associated with UPR-200-E-32, UPR-200-E-34, and UPR-200-E-138
216-B-3A Pond	--	--	--	--	--	--
216-B-3B Pond	--	--	--	--	--	--
216-B-3C Pond	--	--	--	--	--	--
216-A-25 Pond	--	--	--	--	--	Associated with UPR-200-E-34
216-E-28 Contingency Pond	--	--	--	--	--	--
216-N-8 Pond	--	k	s	s	k	--
2101-M Pond	--	s	s	--	--	--
216-B-2-1 Ditch	--	s	s	s	s	Associated with UPR-200-E-32
216-B-2-2 Ditch	--	s	s	s	s	Associated with UPR-200-E-138
216-B-2-3 Ditch	--	--	--	--	--	--
216-B-3-1 Ditch	--	s	--	s	s	Associated with UPR-200-E-34
216-B-3-2 Ditch	--	s	--	s	s	Associated with UPR-200-E-138
216-B-3-3 Ditch	--	s	s	s	s	Associated with UPR-200-E-51
216-B-20 Trench	--	s	--	--	s	--
216-B-21 Trench	--	s	--	--	s	--
216-B-22 Trench	--	s	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-23 Trench	--	s	--	--	s	--
216-B-24 Trench	--	s	--	--	s	--
216-B-25 Trench	--	s	--	--	s	--
216-B-26 Trench	--	s	--	--	s	--
216-B-27 Trench	--	s	--	--	s	--
216-B-28 Trench	--	s	--	--	s	--
216-B-29 Trench	--	s	--	--	s	--
216-B-30 Trench	--	s	--	--	s	--
216-B-31 Trench	--	s	--	--	s	--
216-B-32 Trench	--	s	--	--	s	--
216-B-33 Trench	--	s	--	--	s	--
216-B-34 Trench	--	s	--	--	s	--
216-B-35 Trench	--	s	--	--	s	--
216-B-36 Trench	--	s	--	--	s	--
216-B-37 Trench	--	s	--	--	s	--
216-B-38 Trench	--	s	--	--	s	--
216-B-39 Trench	--	s	--	--	s	--
216-B-40 Trench	--	s	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
216-B-41 Trench	--	s	--	--	s	--
216-B-42 Trench	--	--	--	--	s	--
216-B-52 Trench	--	--	--	--	s	--
216-B-53A Trench	--	--	--	--	--	--
216-B-53B Trench	--	--	--	--	--	--
216-B-54 Trench	--	--	--	--	--	--
216-B-58 Trench	--	--	--	--	--	--
216-B-59 Trench	--	--	--	--	--	--
216-B-63 Trench	--	s	s	s	s	--
Septic Drains and Associated Drain Fields						
2607-E1 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E2 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E3 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-E4 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-E7B Septic Tank	--	--	--	--	--	No reported contaminants
2607-E8 Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-E9 Septic Tank	--	--	--	--	--	No reported contaminants
2607-E11 Septic Tank	--	--	--	--	--	No reported contaminants

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
2607-EB Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EH Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EK Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EM Septic Tank	--	--	--	--	--	No reported contaminants
2607-EN Septic Tank	--	--	--	--	--	No reported contaminants
2607-EO Septic Tank	--	--	--	--	--	No reported contaminants
2607-EP Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-EQ Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
2607-ER Septic Tank	--	--	--	--	--	No reported contaminants
2607-GF Septic Tank/Drain Field	--	--	--	--	--	No reported contaminants
Transfer Facilities, Diversion Boxes, and Pipelines						
241-B-151 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-4 and UPR-200-E-73
241-B-152 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-74 and UPR-200-E-38
241-B-153 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-6 and UPR-200-E-75
241-B-154 Diversion Box	--	s	--	--	s	Associated with UPR-200-E-77 and UPR-200-E-45
241-B-252 Diversion Box	--	--	--	--	--	No reported release

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
241-BR-152 Diversion Box	--	--	--	--	--	No reported release
241-BX-153 Diversion Box	--	--	--	--	--	No reported release
241-BX-154 Diversion Box	--	--	--	--	--	No reported release
241-BX-155 Diversion Box	--	--	--	--	--	Associated with UPR-200-E-78
241-BXR-151 Diversion Box	--	--	--	--	--	No reported release
241-BXR-152 Diversion Box	--	--	--	--	--	No reported release
241-BXR-153 Diversion Box	--	--	--	--	--	No reported release
241-BYR-152 Diversion Box	--	--	--	--	--	No reported release
241-BYR-153 Diversion Box	--	--	--	--	--	No reported release
241-BYR-154 Diversion Box	--	--	--	--	--	No reported release
241-ER-151 Diversion Box	--	--	--	--	--	No reported release
241-ER-152 Diversion Box	--	--	--	--	--	No reported release
242-B-151 Diversion Box	--	--	--	--	--	No reported release
Basins						
207-B Retention Basin	--	--	--	--	--	Associated with UPR-200-E-32
216-B-59B Retention Basin	--	--	--	--	--	
216-B-64 Retention Basin	--	--	--	--	--	Unit never used

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
Burial Sites						
218-E-2 Burial Ground	--	--	--	s	--	--
218-E-2A Burial Ground	--	--	--	--	--	--
218-E-3 Burial Ground	--	--	--	--	--	Exhumed and released from radiation zone status
218-E-4 Burial Ground	--	--	--	s	--	--
218-E-5 Burial Ground	--	s	--	--	s	--
218-E-5A Burial Ground	--	--	--	s	--	--
218-E-6 Burial Ground	--	--	--	--	--	Exhumed and released from radiation zone status
218-E-7 Burial Ground	--	--	--	--	--	--
218-E-9 Burial Ground	--	s	--	s	--	--
218-E-10 Burial Ground	--	s	--	s	s	--
200 Area Construction Pit	--	--	--	--	--	--
200-E Powerhouse Ash Pit	--	--	--	--	--	--
Unplanned Releases						
UN-200-E-1	--	s	--	--	s	--
UN-200-E-2	--	s	--	--	--	--
UN-200-E-3	--	s	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UN-200-E-7	--	--	--	--	s	--
UN-200-E-9	--	k,r	--	--	--	--
UN-200-E-14	--	k,r	--	s	--	--
UN-200-E-41	--	--	--	--	--	Waste line leakage contaminated the stairwell at the 271-B Building
UN-200-E-43	--	s	--	--	s	--
UN-200-E-44	--	s	--	s	--	--
UN-200-E-45	--	s,r?	--	--	s,r?	--
UN-200-E-52	--	s	--	--	--	--
UN-200-E-54	--	k,r?	--	--	s	--
UN-200-E-55	--	--	--	--	--	--
UN-200-E-61	--	--	--	--	--	--
UN-200-E-63	--	--	--	--	--	--
UN-200-E-64	--	--	--	--	--	--
UN-200-E-69	--	--	--	--	--	--
UN-200-E-76	--	s,r?	--	--	s	--
UN-200-E-79	--	s,r?	--	--	s	--
UN-200-E-80	--	k,r?	--	--	k,r?	--
UN-200-E-83	--	--	--	--	--	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UN-200-E-85	--	s	--	--	s	--
UN-200-E-87	--	--	--	--	--	--
UN-200-E-89	--	--	--	--	--	--
UN-200-E-90	--	--	--	--	--	--
UN-200-E-92	--	--	--	--	--	--
UN-200-E-95	--	--	--	--	--	--
UN-200-E-101	--	--	--	--	--	--
UN-200-E-103	--	s,r?	--	--	s,r?	--
UN-200-E-105	--	k,r?	--	--	s	Contaminated area covered with concrete
UN-200-E-109	--	k,r?	--	--	s	Stabilized with asphalt
UN-200-E-110	--	k	--	--	--	--
UN-200-E-112	--	--	--	--	--	--
UN-200-E-140	--	k,r	--	--	s,r	--
UPR-200-E-4	--	--	--	--	--	--
UPR-200-E-5	--	s	--	--	s	--
UPR-200-E-6	--	s	--	--	s	--
UPR-200-E-32	--	s,r?	--	s,r?	s	--
UPR-200-E-34	--	--	--	--	--	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UPR-200-E-38	--	--	--	--	--	--
UPR-200-E-51	--	k	--	s	s	51 kg of cadmium nitrate released
UPR-200-E-73	--	s,r?	--	--	s	--
UPR-200-E-74	--	s,r?	--	--	s	--
UPR-200-E-75	--	s,r?	--	--	s	--
UPR-200-E-77	--	s,r?	--	--	s	--
UPR-200-E-78	--	k,r	--	--	--	--
UPR-200-E-84	--	s	--	--	--	--
UPR-200-E-108	--	s,r	--	--	--	--
UPR-200-E-116	--	k,r?	--	--	--	--
UPR-200-E-127	--	s	--	--	s	--
UPR-200-E-128	--	s,r?	--	--	s	Salt well installed; interstitial liquid removed
UPR-200-E-129	--	s	--	--	s	--
UPR-200-E-130	--	s	--	--	--	--
UPR-200-E-131	--	s	--	--	s	--
UPR-200-E-132	--	s,r?	--	--	s	--
UPR-200-E-133	--	s,r?	--	--	s	--

Table 4-3. Summary of Chemical Contamination in Various Affected Media for B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Air	Surface Soil (0-1 m)	Surface Water	Biota	Vadose Zone	Remarks
UPR-200-E-134	--	s,r?	--	--	s	Salt well installed; interstitial liquid removed
UPR-200-E-135	--	s,r?	--	--	s	Salt well installed
UPR-200-E-138	--	s,r?	s	s,r?	s,r?	--

Notes:

s Suspected contamination, primarily based on WIDS (WHC 1991a) and other waste inventory data.
k Known contamination based on chemical analytical data, WIDS (WHC 1991a), or other sources.
r Complete remediation reported.
r? Remediation attempted, effectiveness not documented.
A dashed line (--) indicates where no data are available.

Table 4-4. Summary of Gamma-Ray Logs. Page 1 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
216-B-43 Crib	E33-1	--	2/28/79[a/] 4/19/68 5/23/63
216-B-44 Crib	E-33-2	--	7/16/87[a/] 5/4/76[a/] 4/27/70 5/23/63 5/11/59
216-B-45 Crib	E33-3	--	2/28/79[a/] 8/4/76[a/] 4/27/70 5/23/63
	E33-22	--	7/16/87[a/] 5/4/76[a/] 8/27/65
216-B-46 Crib	E34-4	--	7/16/87[a/] 5/20/76 4/27/70 5/23/63 1/28/59
	E33-23	--	7/16/87[a/] 5/4/76 4/27/70 9/20/65
216-B-47 Crib	E33-5	--	5/4/76 4/27/70 5/23/69 5/4/59
216-B-48 Crib	E33-6	--	7/16/87[a/] 5/4/76[a/] 4/29/70 5/23/63 5/11/59
216-B-49 Crib	--	--	--
216-B-50 Crib	E33-7	--	2/20/76 7/16/87 4/19/62 1/28/59
	E33-13	--	7/16/87[a/] 5/4/76[a/]
	E33-38	--	2/20/90[a/] 1/9/91[a/]
216-B-57 Crib	E33-24	--	5/4/76 4/27/70 4/19/62

Table 4-4. Summary of Gamma-Ray Logs. Page 2 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
216-B-61 Crib	E33-25	--	2/20/76[a/] 4/24/70
	E33-26	--	5/4/70
216-B-20 Trench	E13-7	--	7/8/87 4/30/76 4/24/68 5/10/63 5/26/59
216-B-21 Trench	E16-8	--	7/9/87[a/] 2/10/76 4/24/68 5/10/63 5/4/59
216-B-22 Trench	E13-9	--	7/8/87[a/] 4/30/76 4/24/66 5/10/63 5/26/59
216-B-23 Trench	--	--	--
216-B-24 Trench	E13-11	--	3/22/84[a/] 4/30/76 5/26/59
216-B-25 Trench	--	--	--
216-B-26 Trench	E13-12	--	7/9/87[a/] 4/30/76 5/26/59
216-B-27 Trench	--	--	--
216-B-28 Trench	E13-19	--	7/10/87[a/] 4/24/68 5/10/63 5/26/59
216-B-29 Trench	E13-14	--	4/3/84[a/] 5/3/76 4/23/68 5/13/63 5/27/59
216-B-30 Trench	--	--	--
216-B-31 Trench	E13-15	--	7/9/87[a/] 5/3/76 4/23/68 5/13/63 5/27/59

9 2 1 2 5 1 1 7 1

Table 4-4. Summary of Gamma-Ray Logs. Page 3 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
	E13-16	--	7/9/87[a/] 3/21/84[a/] 4/30/76 4/25/68 5/13/63 5/26/59
216-B-32 Trench	--	--	--
216-B-33 Trench	--	--	--
216-B-34 Trench	E13-10	--	7/9/87[a/] 4/30/76 4/24/68 5/13/63 5/26/59
	E13-17	--	7/9/87[a/] 5/3/76 5/27/59
	E13-18	--	7/9/87[a/] 5/3/76 5/13/63 5/27/59
	E13-54	--	7/13/87[a/]
	E13-55	--	7/9/87[a/]
	E13-56	--	7/9/87[a/]
	E13-57	--	7/9/87[a/]
	E13-58	--	7/9/87[a/]
	E13-59	--	7/8/87[a/]
	E13-60	--	7/8/87[a/]
	E13-61	--	7/13/87[a/]
216-B-52 Trench	--	--	--
216-B-53A Trench	--	--	--
216-B-53B Trench	--	--	--
216-B-54 Trench	--	--	--
216-B-58 Trench	--	--	--
216-B-14 Crib	E13-1	--	7/13/87[a/]
216-B-15 Crib	E13-2	--	7/13/87[a/]
216-B-16 Crib	E13-3	--	7/10/87[a/]
	E13-21	--	7/10/87[a/]
216-B-17 Crib	E13-4	--	7/13/87[a/]

9 2 1 2 5 1 1 7 2

Table 4-4. Summary of Gamma-Ray Logs. Page 4 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
216-B-18 Crib	E13-5	--	4/18/85[a/]
216-B-19 Crib	E13-6	--	7/10/87[a/]
	E13-20	--	7/10/87[a/]
216-B-9TF Crib and Tile Field	E28-53	--	5/4/76[a/] 5/24/63
	E28-54	--	8/25/87[a/] 5/4/76[a/] 5/24/63[a/]
	E28-55	--	5/4/76[a/] 5/24/63
	E28-56	--	5/4/76[a/]
	E28-57	--	5/4/76[a/]
	E28-58	--	5/4/76[a/] 5/24/63
	E28-59	--	5/4/76[a/]
	E28-60	--	5/4/76[a/]
	E28-61	--	5/4/76[a/] 5/24/63
	E28-2	--	7/6/79[a/] 1/28/76[a/]
	E28-5	--	5/4/76[a/]
241-BX-155 Diversion Box	--	--	--
241-BX-302C Catch Tank	--	--	--
216-B-5 Reverse Well	E28-3	--	1/28/87[a/] 7/6/79[a/]
	E28-1	--	5/4/76[a/]
	E28-7	--	7/15/89[a/]
	E28-4	--	7/15/87[a/] 9/22/87[a/]
	E28-74	--	8/12/87[a/]
241-B-361 Settling Tank	--	--	--
216-B-56 Crib	E28-14	--	2/5/87[a/] 7/6/79[a/] 5/4/76
	E28-4	--	1/2/87[a/] 7/6/79[a/]

Table 4-4. Summary of Gamma-Ray Logs. Page 5 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
216-B-59/59B Trench	--	--	--
241-B-154 Diversion Box	--	--	--
241-B-302B Catch Tank	--	--	--
216-B-12 Crib	E28-9	--	8/25/87[a/] 5/5/76[a/]
	E28-16	--	5/5/76
	E28-64	--	5/5/76 9/2/67
	E28-65	--	5/5/76[a/] 9/2/68
	E28-66	--	5/5/76[a/] 9/27/68
	E28-76	--	8/25/87[a/]
216-B-55 Crib	E28-12	--	9/27/91[a/] 3/20/84[a/] 10/8/80[a/] 2/19/76[a/] 4/28/70 4/18/68
	E28-13	--	9/29/82[a/]
	E28-18	--	9/29/82[a/]
	E28-19	--	3/20/84[a/]
216-B-60 Crib	--	--	--
216-B-64 Retention Basin	--	--	--
218-E-6 Burial Ground	--	--	--
216-B-2-1 Ditch	--	--	--
216-B-2-3 Ditch	--	--	--
216-B-62 Ditch	E28-18	--	4/9/87[a/] 10/8/80[a/] 2/19/76
	E28-20	--	9/17/91[a/] 3/23/90[a/] 3/20/84[a/] 10/8/80[a/] 5/4/76
216-B-63 Trench	--	--	--

Table 4-4. Summary of Gamma-Ray Logs. Page 6 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
	E28-21	--	9/27/82[a/] 10/8/80[a/] 5/3/76
	E28-75	--	9/17/91[a/] 3/23/90[a/] 9/21/84[a/] 3/21/84[a/]
	E33-286	--	7/15/87[a/]
	E33-287	--	7/15/87[a/]
	E33-288	--	7/15/87[a/]
	E33-289	--	7/15/87[a/]
	E33-290	--	7/15/87[a/]
218-E-2 Burial Ground	--	--	--
218-E-2A Burial Ground	--	--	--
218-E-4 Burial Ground	--	--	--
218-E-5 Burial Ground	--	--	--
218-E-5A Burial Ground	--	--	--
218-E-8 Burial Ground	--	--	--
216-B-35 Trench		--	--
216-B-36 Trench	E33-10	--	12/3/76[a/]
	E33-21	--	5/4/76[a/] 4/27/70 5/17/63 5/4/59
216-B-37 Trench	--	--	--
216-B-38 Trench	--	--	--
216-B-39 Trench	--	--	--
216-B-40 Trench	--	--	--
216-B-41 Trench	E33-8	--	2/20/76[a/] 5/4/59
216-B-42 Trench	--	--	--
216-B-7A,B Cribs	E33-18	--	5/5/76[a/] 5/5/59
	E33-58	--	5/5/76[a/] 5/23/63
	E33-59	--	5/5/76[a/] 5/23/63

9 2 1 2 7 5

Table 4-4. Summary of Gamma-Ray Logs.

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
	E33-75	--	5/5/76[a/] 5/22/63
218-B-8TF Crib and Tile Field	E33-15	--	5/5/76[a/] 5/5/59
	E33-16	--	2/20/76[a/] 4/28/68 5/22/63 5/5/59
	E28-57	--	5/4/76 5/24/63
	E33-66	--	5/5/76[a/] 5/22/63
	E33-67	--	5/5/76[a/] 5/22/63
	E33-68	--	5/5/76[a/] 5/22/63
	E33-69	--	5/5/76[a/] 5/22/63
	E33-70	--	5/5/76[a/] 5/22/63
	E33-71	--	5/5/76[a/] 5/22/63
	E33-72	--	5/5/76
	E33-73	--	5/5/76[a/] 5/22/63
	E33-74	--	5/5/76[a/] 5/22/63
	E33-76	--	5/5/76[a/]
	E33-89	--	5/5/76[a/] 5/22/63
	E33-12	--	5/4/76
	E33-89	--	1/21/91[a/]
216-B-11A,B Reverse Wells	E33-20	--	2/20/76[a/]
	E33-19	--	5/5/76[a/] 5/5/59
216-B-51 French Drain	E33-11	--	5/5/76[a/] 4/24/70 5/20/63 5/5/59

Table 4-4. Summary of Gamma-Ray Logs. Page 8 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
	E33-14	--	5/5/78[a/] 4/24/70 5/20/63
216-B-4 Reverse Well	--	--	--
216-B-6 Reverse Well	--	--	--
216-B-10A,B Cribs	E28-17	--	5/5/76
216-B-13 French Drain	--	--	--
216-B-3 Pond	6-43-43	--	9/1/88[a/]
	6-43-45	--	6/6/89[a/]
	6-44-42	--	9/19/88[a/]
	6-44-43B	--	5/18/89[a/]
	6-45-42	--	8/18/80[a/]
216-B-3A Pond	6-42-41	--	7/30/91[a/]
	6-42-42A	--	7/2/80[a/]
	6-42-42B	--	9/14/88[a/]
	6-43-40	--	8/27/91[a/]
	6-43-42	--	5/27/80[a/]
	6-43-42J	--	8/10/88[a/]
	6-42-42K	--	11/18/88[a/]
216-B-3B Pond	6-42-39A	--	8/2/91[a/]
	6-42-40C	--	7/14/82[a/]
	6-43-41E	--	4/18/89[a/]
	6-43-41F	--	4/28/89[a/] 4/18/89[a/]
216-B-3C Pond	6-39-39	--	5/6/80[a/]
	6-40-39	--	6/29/89[a/] 4/25/89[a/]
	64-40-40A	--	9/17/91[a/] 8/30/91[a/]
	6-40-40B	--	9/19/91[a/] 8/12/91[a/] 7/31/91[a/] 7/24/91[a/]
	6-40-43	--	10/24/91[a/]
	6-41-40	--	6/8/89[a/] 5/23/89[a/]

Table 4-4. Summary of Gamma-Ray Logs. Page 9 of 9

Waste Management Unit	Well Number	Number of Times Logged	Inclusive Dates
216-B-3-1 Ditch	--	--	--
216-B-3-2 Ditch	--	--	--
216-B-3-3 Ditch	--	--	--
216-E-28 Pond	--	--	--
218-E-3 Burial Ground	--	--	--

[a] Digitized Logs
A dashed line (--) indicates where no data are available.

Table 4-5. Results of External Radiation Monitoring, 1985 through 1989: TLDs (mrem/yr). Page 1 of 4

Location	1985	1986	1987	1988	1989	Average Total
2E1: 200 East Area NW						
Max	83	102	88	112	--	96
Min	62	69	49	85	--	66
Total	72	82	74	96	--	81
2E2: 241-BY Tank Farm NW						
Max	90	109	115	135	--	112
Min	69	78	86	103	--	84
Total	80	92	99	113	--	96
2E3: 241-B, -BY Tank Farm N						
Max	137	154	158	180	--	157
Min	104	11	118	139	--	93
Total	124	123	141	155	--	138
2E7: E-10 W						
Max	78	95	99	129	--	100
Min	66	70	77	92	--	76
Total	73	80	92	107	--	88
2E8: E-10E						
Max	83	100	96	120	124	105
Min	69	76	84	91	80	80
Total	76	86	90	105	104	92
2E9: 241-BX Tank Farm S						
Max	136	142	137	162	140	143
Min	105	98	119	121	92	107
Total	115	117	127	139	126	125

Table 4-5. Results of External Radiation Monitoring, 1985 through 1989: TLDs (mrem/yr). Page 2 of 4

Location	1985	1986	1987	1988	1989	Average Total
2E13: 200 East Area W						
Max	77	95	95	104	--	93
Min	68	65	75	84	--	73
Total	71	76	83	97	--	82
2E14: B Plant W						
Max	87	100	100	109	112	102
Min	63	71	83	87	104	82
Total	76	83	90	101	106	91
2E15: B Plant NE						
Max	105	136	107	121	120	118
Min	73	84	93	99	108	91
Total	92	105	100	112	113	86
2E19: 200 East Area W						
Max	84	98	93	108	--	96
Min	63	72	82	87	--	76
Total	75	81	88	97	--	85
2E20: B Plant SSW						
Max	69	95	93	106	104	93
Min	67	68	72	60	80	69
Total	68	79	83	88	96	83

Table 4-5. Results of External Radiation Monitoring, 1985 through 1989: TLDs (mrem/yr). Page 3 of 4

Location	1985	1986	1987	1988	1989	Average Total
2E21: B Plant SSE						
Max	83	97	94	110	116	100
Min	64	70	75	66	68	69
Total	74	80	87	91	98	86
2E25: 200 East Area W						
Max	76	98	91	109	--	94
Min	59	67	69	65	--	65
Total	68	79	78	90	--	79
2E26: 2101-M W						
Max	82	99	98	116	--	99
Min	63	73	79	66	--	70
Total	72	81	88	95	--	84
2E27: 2101-M E						
Max	70	91	89	109	--	90
Min	60	67	72	65	--	66
Total	66	75	80	87	--	77
2E31: U.S. Ecology N						
Max	76	88	92	107	--	91
Min	62	67	70	61	--	65
Total	70	75	82	86	--	78

Table 4-5. Results of External Radiation Monitoring, 1985 through 1989: TLDs (mrem/yr).

Location	1985	1986	1987	1988	1989	Average Total
2E32: B-C Cribs NW						
Max	79	98	95	111	--	96
Min	61	66	70	61	--	65
Total	69	79	84	93	--	81
2E33: 200 East Area S						
Max	79	89	90	107	108	95
Min	61	68	74	61	72	67
Total	69	75	81	90	93	82

Source: Schmidt et al. 1990; Elder et al. 1986, 1987, 1988, 1989.

Table 4-6. Results of External Radiation Monitoring for 1990: TLDs (mrem/yr).

Location	Maximum	Minimum	Total
225: 216-B-3-3 Ditch	152	92	119
226: Gable Mt. Pond East	112	88	98
227: Gable Mt. Pond North	104	80	88
228: West Lake	128	92	106
229: 218-E-10 East[a/]	132	104	121
230: 241-BX Tank Farm South[b/]	192	108	138
232: 216-B-12 East	120	100	108
233: 221-B West[c/]	128	104	116
234: 221-B Northeast[d/]	140	96	114
235: 221-B Southwest	112	96	102
236: 221-B SSW[e/]	112	100	107
237: 216-B-55-1	128	92	115
238: 216-B-55-2	116	92	103
239: 216-B-62-1	112	92	98
240: 216-B-62-2	112	96	98
241: 216-B-63	128	96	106

Source: Schmidt et al. 1991
Note: The TLD location numbering system changed for 1990.
a/ This site was formerly 2E8.
b/ This site was formerly 2E9.
c/ This site was formerly 2E14.
d/ This site was formerly 2E15.
e/ This site was formerly 2E20.

Table 4-7. Results of External Radiation Surveys. Page 1 of 8

Waste Management Unit	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Radiation Survey Date	Radiation Type
Plants, Buildings, and Storage Areas					
2703-E Hazardous Waste Staging Area	NA	NA	NA	NA	NA
2704-E Hazardous Waste Staging Area	NA	NA	NA	NA	NA
2715-EA Hazardous Waste Staging Area	NA	NA	NA	NA	NA
226-B Hazardous Waste Staging Facility	NA	NA	NA	NA	NA
Tanks and Vaults					
241-B-301B Catch Tank	NA	NA	NA	NA	NA
241-B-302B Catch Tank	NA	NA	NA	NA	NA
241-BX-302A Catch Tank	NA	NA	NA	NA	NA
241-BX-302B Catch Tank	NA	NA	NA	NA	NA
241-BX-302C Catch Tank	NA	NA	NA	NA	NA
241-ER-311 Catch Tank	NA	NA	NA	NA	NA
241-B-361 Settling Tank	NA	NA	NA	NA	NA
244-BXR Receiving Vault	NA	NA	NA	NA	NA
270-E CN Tank	NA	NA	NA	NA	NA
Cribs and Drains					
216-B-7A Crib	--	15,000	--	Mar-92	Beta
216-B-7B Crib	--	12,000	--	Mar-92	Beta
216-B-8TF Crib	--	6,000	--	Mar-92	Beta
216-B-9TF Crib	NC	NC	NC	Mar-92	--
216-B-10A Crib	NC	NC	NC	Mar-92	--
216-B-10B Crib	NC	NC	NC	Mar-92	--
216-B-12 Crib	NC	NC	NC	Mar-92	--
216-B-14 Crib	NC	NC	NC	Nov-91	--
216-B-15 Crib	NC	NC	NC	Nov-91	--
215-B-16 Crib	NC	NC	NC	Nov-91	--
216-B-17 Crib	NC	NC	NC	Nov-91	--
216-B-18 Crib	NC	NC	NC	Nov-91	--

Table 4-7. Results of External Radiation Surveys. Page 2 of 8

Waste Management Unit	Radiation Surveys ct/min	dis/min	mrem/h	Radiation Survey Date	Radiation Type
216-B-19 Crib	NA	NC	NC	Nov-91	--
216-B-43 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-44 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-45 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-46 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-47 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-48 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-49 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-50 Crib	--	6,000-20,000[b/]	--	Mar-90	Beta
216-B-55 Crib	--	2,000[b/]	--	Mar-92	Beta
216-B-56 Crib	NC	NC	NC	Mar-92	--
216-B-57 Crib	NC	NC	NC	Mar-92	--
216-B-60 Crib	NA	NA	NA	NA	--
216-B-61 Crib	NA	NA	NA	Dec-90	--
216-B-62 Crib	NC	NC	NC	Mar-92	--
216-B-13 French Drain	NC	NC	NC	Mar-92	--
216-B-51 French Drain	--	4,000	--	Mar-92	Beta
Reverse Wells					
216-B-4 Reverse Well	NC	NC	NC	Mar-92	--
216-B-5 Reverse Well	--	6,000[b/]	--	Mar-92	Beta
216-B-6 Reverse Well	NC	NC	NC	Mar-92	--
216-B-11A Reverse Well	--	6,000[b/]	--	Mar-92	Beta
216-B-11B Reverse Well	--	6,000[b/]	--	Mar-92	Beta
Ponds, Ditches, and Trenches					
216-B-3 Pond	--	4,000	--	Aug-91	Beta
216-B-3A Pond	NA	NA	NA	NA	--
216-B-3B Pond	NA	NA	NA	NA	--
216-B-3C Pond	NA	NA	NA	NA	--
216-A-25 Pond	NC	NC	NC	Oct-90	--
216-E-28 Contingency Pond	NA	NA	NA	NA	--

Table 4-7. Results of External Radiation Surveys. Page 3 of 8

Waste Management Unit	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Radiation Survey Date	Radiation Type
216-N-8 Pond	NC	NC	NC	Feb-90	--
2101-M Pond	NA	NA	NA	NA	--
216-B-2-1 Ditch	--	20,000[a/]	--	Apr-91	Beta
216-B-2-2 Ditch	--	20,000[a/]	--	Apr-91	Beta
216-B-2-3 Ditch	--	20,000[a/]	--	Apr-91	Beta
216-B-3-1 Ditch	NC	NC	NC	Mar-92	--
216-B-3-2 Ditch	NC	NC	NC	Mar-92	--
216-B-3-3 Ditch	NC	NC	NC	Feb-92	--
216-B-20 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-21 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-22 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-23 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-24 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-25 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-26 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-27 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-28 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-29 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-30 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-31 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-32 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-33 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-34 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-35 Trench	NC	NC	NC	Apr-92	--
216-B-36 Trench	NC	NC	NC	Apr-92	--
216-B-37 Trench	NC	NC	NC	Apr-92	--
216-B-38 Trench	NC	NC	NC	Apr-92	--
216-B-39 Trench	NC	NC	NC	Apr-92	--
216-B-40 Trench	NC	NC	NC	Apr-92	--
216-B-41 Trench	NC	NC	NC	Apr-92	--

Table 4-7. Results of External Radiation Surveys. Page 4 of 8

Waste Management Unit	Radiation Surveys ct/min	dis/min	mrem/h	Radiation Survey Date	Radiation Type
216-B-42 Trench	NC	NC	NC	Apr-92	--
216-B-52 Trench	NC	NC	NC	Sep-84	--
216-B-53A Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-53B Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-54 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-58 Trench	--	80,000[b/]	--	Nov-91	Beta
216-B-63 Trench	NC	NC	NC	Aug-90	Beta
Septic Tanks and Associated Drain Fields					
2607-E1 Septic Tank	NA	NA	NA	NA	--
2607-E2 Septic Tank	NA	NA	NA	NA	--
2607-E3 Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-E4 Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-E7B Septic Tank	NA	NA	NA	NA	--
2607-E8 Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-E9 Septic Tank	NA	NA	NA	NA	--
2607-E11 Septic Tank	NA	NA	NA	NA	--
2607-EB Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-EH Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-EK Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-EM Septic Tank	NA	NA	NA	NA	--
2607-EN Septic Tank	NA	NA	NA	NA	--
2607-EO Septic Tank	NA	NA	NA	NA	--
2607-EP Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-EQ Septic Tank/ Drain Field	NA	NA	NA	NA	--
2607-ER Septic Tank	NA	NA	NA	NA	--

Table 4-7. Results of External Radiation Surveys. Page 5 of 8

Waste Management Unit	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Radiation Survey Date	Radiation Type
2607-GF Septic Tank/ Drain Field	NA	NA	NA	NA	--
Transfer Facilities, Diversion Boxes, and Pipelines					
241-B-151 Diversion Box	NA	NA	NA	NA	--
241-B-152 Diversion Box	NA	NA	NA	NA	--
241-B-153 Diversion Box	NA	NA	NA	NA	--
241-B-154 Diversion Box	NA	NA	NA	NA	--
241-B-252 Diversion Box	NA	NA	NA	NA	--
241-BR-152 Diversion Box	NA	NA	NA	NA	--
241-BX-153 Diversion Box	NA	NA	NA	NA	--
241-BX-154 Diversion Box	NA	NA	NA	NA	--
241-BX-155 Diversion Box	NA	NA	NA	NA	--
241-BXR-151 Diversion Box	NA	NA	NA	NA	--
241-BXR-152 Diversion Box	NA	NA	NA	NA	--
241-BXR-153 Diversion Box	NA	NA	NA	NA	--
241-BYR-152 Diversion Box	NA	NA	NA	NA	--
241-BYR-153 Diversion Box	NA	NA	NA	NA	--
241-BYR-154 Diversion Box	NA	NA	NA	NA	--
241-ER-151 Diversion Box	NA	NA	NA	NA	--
241-ER-152 Diversion Box	NA	NA	NA	NA	--
242-B-151 Diversion Box	NA	NA	NA	NA	--
Basins					
207-B Retention Basin	200-600	--	--	Jul-90	--
216-B-59 Retention Basin	NC	NC	NC	Oct-89	--
216-B-64 Retention Basin	--	1,000,000	--	Mar-92	Beta

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Table 4-7. Results of External Radiation Surveys.

Waste Management Unit	Radiation Surveys			Radiation Survey Date	Radiation Type
	ct/min	dis/min	mrem/h		
Burial Sites					
218-E-2 Burial Ground	10,000[a/]	--	--	Nov-90	--
218-E-2A Burial Ground	NC	NA	NA	Oct-90	--
218-E-3 Burial Ground	NA, NC	NA	NA	NA	--
218-E-4 Burial Ground	4,000[a/]	--	--	Oct-90	--
218-E-5 Burial Ground	10,000[a/]	--	--	Nov-90	--
218-E-5A Burial Ground	10,000[a/]	--	--	Nov-90	--
218-E-6 Burial Ground	NA, NC	NA	NA	NA	--
218-E-7 Burial Ground	NA	NA	NA	NA	--
218-E-9 Burial Ground	10,000[a/]	--	--	Nov-90	--
218-E-10 Burial Ground	NA	NA	NA	NA	--
200 Area Construction Pit	NA	NA	NA	NA	--
200-E Powerhouse Ash Pit	NA	NA	NA	NA	--
Unplanned Releases					
UN-200-E-1	NA	NA	NA	NA	--
UN-200-E-2	NA	NA	NA	NA	--
UN-200-E-3	NA	NA	NA	NA	--
UN-200-E-7	NA	NA	NA	NA	--
UN-200-E-9	NA	NA	NA	NA	--
UN-200-E-14	NA	NA	NA	NA	--
UN-200-E-41	NA	NA	NA	NA	--
UN-200-E-43	NA	NA	NA	NA	--
UN-200-E-44	NA	NA	NA	NA	--
UN-200-E-45	NA	NA	NA	NA	--
UN-200-E-52	NA	NA	NA	NA	--
UN-200-E-54	NA	NA	NA	NA	--
UN-200-E-55	NA	NA	NA	NA	--
UN-200-E-61	NA	NA	NA	NA	--
UN-200-E-63	100,000	6,000	--	Jun-81	gamma (dis/min)
UN-200-E-64	NA	NA	NA	NA	--

Table 4-7. Results of External Radiation Surveys. Page 7 of 8

Waste Management Unit	Radiation Surveys			Radiation Survey Date	Radiation Type
	ct/min	dis/min	mrem/h		
UN-200-E-69	NA	NA	NA	NA	--
UN-200-E-76	NA	NA	NA	NA	--
UN-200-E-79	NA	NA	NA	NA	--
UN-200-E-80	NA	NA	NA	NA	--
UN-200-E-83	NA	NA	NA	NA	--
UN-200-E-85	200[c/]	--	--	1975	--
UN-200-E-87	NC	NC	NC	Sep-89	--
UN-200-E-89	1,000-2,000[b/] 200-400[b/] 100,000[b/]	--	--	1978 Sep-90	--
UN-200-E-90	NA	NA	NA	NA	--
UN-200-E-92	NA	NA	NA	NA	--
UN-200-E-95	200-400	4,000[b/]	--	Sep-90	--
UN-200-E-101	NC	NC	NC	Sep-90	--
UN-200-E-103	NA	NA	NA	NA	--
UN-200-E-105	NA	NA	NA	NA	--
UN-200-E-109	NA	NA	NA	NA	--
UN-200-E-110	NA	NA	NA	NA	--
UN-200-E-112	NA	NA	NA	NA	--
UN-200-E-140	NA	NA	NA	NA	--
UPR-200-E-4	NA	NA	NA	NA	--
UPR-200-E-5	NA	NA	NA	NA	--
UPR-200-E-6	NA	NA	NA	NA	--
UPR-200-E-32	20,000[b/] 2,000[a/] 4,000[b/]	--	--	Sep-89	--
UPR-200-E-34	NA	NA	NA	NA	--
UPR-200-E-38	NA	NA	NA	NA	--
UPR-200-E-51	NA	NA	NA	NA	--
UPR-200-E-73	NA	NA	NA	NA	--
UPR-200-E-74	30,000	--	--	1975	--
UPR-200-E-75	NA	NA	NA	NA	--

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Table 4-7. Results of External Radiation Surveys. Page 8 of 8

Waste Management Unit	Radiation Surveys			Radiation Survey Date	Radiation Type
	ct/min	dis/min	mrem/h		
UPR-200-E-77	200-600	--	2[b]	Sep-90	--
UPR-200-E-78	150	5[b]	--	Sep-90	--
UPR-200-E-84	90,000 3,000	--	--	Oct-75 Sep-90	--
UPR-200-E-108	NA	NA	NA	NA	--
UPR-200-E-116	NA	NA	NA	NA	--
UPR-200-E-127	NA	NA	NA	NA	--
UPR-200-E-128	NA	NA	NA	NA	--
UPR-200-E-129	NA	NA	NA	NA	--
UPR-200-E-130	NA	NA	NA	NA	--
UPR-200-E-131	NA	NA	NA	NA	--
UPR-200-E-132	NA	NA	NA	NA	--
UPR-200-E-133	NA	NA	NA	NA	--
UPR-200-E-134	NA	NA	NA	NA	--
UPR-200-E-135	NA	NA	NA	NA	--
UPR-200-E-138	NA	NA	NA	NA	--

a/ Tumbleweeds/vegetation
b/ Localized spot
c/ Elevated background levels
NA - Not available
NC - No contamination detected
A dashed line (--) indicates where no data are available.

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Table 4-8. Summary of Grid Soil Sampling Results (pCi/g).

Radionuclide	Site								
	2 E1[a/]	2 E2[a/]	2 E3[a/]	2 E7[a/]	2 E8[a/]	2 E9[a/]	2 E13[a/]	2 E14[a/]	2 E15[a/]
Ce-141	-9.40E-03	--	-2.59E-02	--	3.07E-02	-8.10E-02	3.44E-02	1.37E-02	--
Ce-144	-2.80E-02	-2.10E-04	1.91E-02	4.40E-02	-6.10E-03	-1.86E-02	4.66E-02	-4.43E-03	-7.70E-03
Co-58	-2.95E-03	1.74E-02	2.85E-03	8.00E-03	8.23E-03	5.52E-03	3.23E-03	6.00E-04	-1.30E-02
Co-60	-5.85E-03	1.80E-02	5.80E-03	-1.40E-03	1.15E-02	5.60E-03	7.34E-03	1.20E-02	-1.50E-03
Cs-134	-2.65E-02	4.00E-02	-1.50E-03	-1.00E-02	-1.40E-03	-1.73E-02	3.42E-02	1.56E-02	1.78E-02
Cs-137	2.45E+00	2.39E+00	2.22E+01	1.80E+00	7.40E+00	1.74E+01	7.72E-01	6.10E+00	1.35E+00
Eu-152	9.65E-02	1.30E-01	1.02E-01	8.10E-02	1.08E-01	1.48E-01	1.02E-01	6.57E-02	1.13E-01
Eu-154	-3.10E-02	6.20E-02	2.78E-02	2.40E-02	2.22E-02	-1.29E-02	4.02E-02	-3.55E-02	5.70E-02
Eu-155	9.30E-02	8.35E-02	1.07E-01	6.60E-02	5.59E-02	1.74E-04	7.85E-02	6.96E-02	4.10E-02
I-129	--	--	-1.68E+00	--	-2.18E-01	8.29E-02	9.19E-02	1.88E-01	--
K-40	--	--	1.52E+01	--	1.38E+01	1.32E+01	1.36E+01	1.48E+01	--
Mn-54	1.33E-02	2.30E-02	1.30E-02	-5.90E-03	2.39E-02	-4.39E-02	2.32E-03	1.72E-02	6.40E-03
Nb-95	--	--	-4.12E-02	--	-1.56E-01	-5.88E-02	2.31E-02	1.03E-01	--
Pb-212	--	--	8.84E-01	--	8.95E-01	6.87E-01	6.37E-01	1.85E-01	--
Pb-214	7.00E-01	7.90E-01	7.24E-01	7.20E-01	7.15E-01	6.42E-01	5.38E-01	6.71E-01	6.60E-01
Pu-238	2.04E-03	7.42E-04	9.00E-04	4.60E-04	1.23E-03	1.00E-03	3.94E-03	3.78E-04	5.90E-04
Pu-239	1.23E-01	1.23E-02	3.05E-02	3.80E-01	5.49E-02	2.00E-02	3.71E-02	1.52E-02	3.98E-02
Ru-106	-8.00E-02	--	7.14E-02	-4.70E-02	-4.21E-02	1.29E-01	2.83E-02	-1.40E-02	-4.00E-02
Sr-90	3.40E-01	1.73E-01	9.10E-01	3.30E-01	5.55E-01	2.28E+00	1.99E-01	6.92E-01	1.05E+00
Tc-99	--	--	4.80E-01	--	4.78E-01	3.28E-01	9.95E-01	2.17E-01	--
U (total)	1.55E-01	2.12E-01	2.08E-01	2.90E-01	2.97E-01	2.38E-01	3.05E-01	2.40E-01	3.24E-01
Zn-65	-3.40E-02	-1.20E-01	-8.03E-02	-4.60E-02	-5.15E-02	-8.75E-02	4.54E-02	2.18E-03	-3.90E-02
Zr-95	9.00E-03	-7.30E-03	5.36E-03	-5.50E-03	2.92E-02	1.42E-03	2.16E-02	2.05E-02	5.90E-03
Ce-141	-1.80E-02	5.20E-02	-4.70E-02	--	-1.10E-02	--	--	2.50E-02	--

Table 4-8. Summary of Grid Soil Sampling Results (pCi/g).

	Site								
Radionuclide	2 E19[a]	2 E20[a]	2 E21[a]	2 E25[a]	2 E26[a]	2 E27[a]	2 E31[a]	2 E32[a]	2 E33[a]
Ce-144	8.15E-02	-3.51E-02	3.85E-02	-3.10E-02	1.22E-02	4.70E-02	-6.30E-02	-2.85E-02	-5.00E-03
Co-58	-1.85E-02	1.91E-02	3.35E-03	1.60E-02	-3.20E-03	1.70E-02	1.80E-03	-1.30E-02	1.70E-02
Co-60	3.10E-03	6.83E-03	4.03E-03	5.80E-03	-8.90E-03	3.20E-03	2.55E-02	-1.12E-02	-4.50E-03
Cs-134	8.00E-03	8.80E-03	2.05E-02	-8.10E-03	2.63E-902	1.55E-02	3.17E-02	3.25E-02	-1.50E-03
Cs-137	9.00E-01	2.52E+00	8.70E-01	4.60E-01	7.40E-01	2.57E-01	4.58E-01	8.38E-01	5.85E-02
Eu-152	5.80E-02	1.10E-01	8.20E-02	7.50E-02	1.35E-02	7.95E-02	1.17E-01	7.64E-02	5.70E-02
Eu-154	-8.85E-03	7.14E-02	3.70E-02	1.10E-02	4.35E-02	8.00E-02	4.65E-02	3.67E-03	-1.70E-02
Eu-155	5.65E-02	8.28E-02	5.05E-02	5.00E-02	5.20E-02	3.60E-02	3.50E-02	8.20E-02	4.50E-02
I-129	--	-5.94E-01	-9.10E-02	--	--	--	--	--	--
K-40	--	1.51E+01	--	--	--	--	--	--	--
Mn-54	-1.00E-03	1.33E-02	1.61E-02	1.70E-02	1.15E-02	2.40E-02	2.00E-02	1.29E-02	1.09E-02
Nb-95	--	-3.70E-04	--	--	--	--	--	--	--
Pb-212	--	7.79E-01	--	--	--	--	--	--	--
Pb-214	3.60E-01	6.47E-01	6.60E-01	5.60E-01	6.50E-01	5.60E-01	5.70E-01	6.10E-01	5.10E-01
Pu-238	7.40E-04	4.71E-04	4.00E-04	4.90E-04	5.00E-04	--	5.15E-04	5.20E-05	1.70E-04
Pu-239	2.70E-02	3.20E-02	3.70E-02	1.30E-02	1.55E-02	3.70E-03	9.67E-03	1.37E-02	9.00E-04
Ru-106	9.00E-03	1.10E-02	1.73E-02	--	7.10E-02	1.80E-03	2.22E-01	-1.00E-02	-5.10E-02
Sr-90	1.90E-01	6.16E-01	2.71E-01	4.20E-02	4.45E-01	3.92E-01	2.82E-01	6.00E-01	1.82E-01
Tc-99	--	1.26E-01	4.60E-01	--	--	--	--	--	--
U (total)	2.80E-01	3.29E-01	2.86E-01	3.00E-01	2.85E-01	3.65E-01	3.18E-01	2.89E-01	2.40E-01
Zn-65	-3.79E-02	-9.60E-02	-1.10E-02	-5.20E-02	-2.03E-01	-1.40E-01	-3.80E-02	-4.00E-02	-4.50E-02
Zr-95	2.60E-02	3.04E-02	2.30E-02	1.50E-02	-2.59E-03	1.30E-03	2.70E-02	5.33E-04	4.05E-02

[a] All values are averages for each year with a detection since 1985.
A dashed line (--) indicates where no data are available.

Table 4-9. Summary of Fenceline Soil Sampling Results.

Radionuclide	Site			
	2E-N[a/]	B-TF-NE[a/]	B-TF-SE[a/]	BX-TF-W[a/]
Ce-141	-1.76E-02	-3.83E-02	-7.33E-03	1.97E-03
Ce-144	-8.70E-02	4.65E-02	-4.26E-02	-6.00E-03
Co-58	2.30E-03	3.31E-03	7.20E-03	-2.07E-02
Co-60	1.03E-02	1.64E-02	9.37E-03	-9.30E-03
Cs-134	2.28E-02	-1.08E-02	-6.33E-03	4.17E-03
Cs-137	9.42E+00	1.57E+02	1.64E+01	4.70E+00
Eu-152	9.75E-02	4.23E-02	1.48E-02	8.55E-02
Eu-154	-5.60E-03	-4.71E-02	4.92E-02	-2.89E-02
Eu-155	5.90E-02	9.40E-02	4.53E-02	1.44E-02
K-40	1.58E+01	1.39E+01	1.43E+01	1.33E+01
Mn-54	1.98E-02	5.79E-03	7.21E-03	7.57E-03
Nb-95	1.34E-02	-3.71E-02	-4.84E-02	-6.80E-02
Pb-212	8.38E-01	4.31E-01	6.78E-01	5.89E-01
Pb-214	6.92E-01	5.57E-01	5.84E-01	5.62E-01
Pu-238	-3.20E-05	2.60E-04	3.75E-04	2.35E-04
Pu-239	4.30E-03	7.40E-03	9.50E-03	4.95E-03
Ru-106	-1.33E-03	-1.12E-01	-5.60E-02	-2.10E-02
Sr-90	1.55E+00	7.56E+00	6.96E+00	2.69E-01
U (total)	8.70E-02	3.20E-01	1.22E-01	3.32E-01
Zn-65	-5.23E-02	-4.57E-02	-1.37E-02	2.99E-02
Zr-95	1.55E-03	2.41E-02	1.50E-02	-3.37E-03

[a/] All values are averages for each year with a detection since 1985.

Table 4-10. Summary of Vegetation Sampling Results (pCi/g).

	Site								
Radionuclide	2 E1[a/]	2 E2[a/]	2 E3[a/]	2 E7[a/]	2 E8[a/]	2 E9[a/]	2 E13[a/]	2 E14[a/]	2 E15[a/]
Be-7	--	--	--	--	--	--	--	--	--
Ce-141	-7.70E-03	-7.70E-03	-1.79E-02	-5.20E-02	-1.54E-02	6.10E-03	-5.20E-03	-1.43E-02	3.50E-02
Co-58	--	--	--	--	--	--	--	--	--
Co-60	-1.90E-03	1.85E-02	2.25E-02	-3.10E-03	1.36E-02	1.56E-02	3.74E-03	1.18E-02	-1.40E-03
Cs-134	4.30E-02	7.98E-02	--	--	1.45E-01	--	1.19E-01	3.91E-02	--
Cs-137	8.98E-02	3.02E-01	4.63E-01	8.60E-02	1.32E-01	2.26E-01	2.48E+01	5.12E-01	1.76E-01
Eu-152	5.40E-02	6.48E-02	-2.39E-02	-2.30E-02	8.48E-02	6.41E-02	6.24E-02	3.07E-02	5.70E-02
Eu-154	3.11E-02	4.10E-02	1.03E-02	-7.10E-02	1.34E-02	1.66E-02	-9.74E-03	1.25E-02	-8.90E-03
Eu-155	1.88E-02	6.20E-03	5.71E-02	-2.20E-03	5.16E-02	3.25E-02	-9.30E-03	1.40E-03	3.57E-02
I-129	--	--	-2.29E-01	--	6.43E-02	1.62E-01	1.29E-01	3.17E-02	--
K-40	--	--	1.10E+01	--	1.09E+01	1.09E+01	1.27E+01	1.27E+01	--
Nb-95	8.43E-03	6.00E-02	-2.24E-02	6.24E-04	1.70E-02	-3.66E-03	1.71E-02	3.53E-03	1.50E-02
Pb-212	--	--	-4.25E-01	--	5.21E-02	5.21E-02	6.24E-02	6.24E-02	--
Pb-214	--	--	5.33E-02	--	3.91E-02	3.91E-02	7.09E-02	7.09E-02	--
Pu-238	--	--	1.22E-04	--	9.34E-05	3.92E-05	2.20E-03	2.20E-03	--
Pu-239	4.00E-04	--	7.26E-04	--	1.80E-03	1.75E-03	5.79E-03	5.79E-03	--
Ru-103	--	--	--	--	1.94E-01	--	1.75E-01	--	1.04E-01
Ru-106	--	--	--	--	--	--	--	--	--
Sr-90	2.15E-01	--	2.48E-01	--	4.31E-02	4.16E-01	1.21E-01	7.15E-02	--
Tc-99	--	--	6.07E-01	--	8.03E-02	3.60E-01	4.26E-01	3.68E-01	--
Zr-95	6.00E-03	3.50E-02	6.79E-03	-3.70E-02	-1.36E-02	7.50E-04	1.01E-02	1.19E-02	-7.10E-02

Table 4-10. Summary of Vegetation Sampling Results (pCi/g). Page 2 of 2

	Site								
Radionuclide	2 E19[a]	2 E20[a]	2 E21[a]	2 E25[a]	2 E26[a]	2 E27[a]	2 E31[a]	2 E32[a]	2 E33[a]
Be-7	--	--	--	--	--	--	--	--	--
Ce-141	-2.10E-02	-1.52E-02	2.60E-02	-3.20E-03	3.00E-02	-8.40E-02	3.50E-02	-8.60E-03	-5.20E-02
Co-58	--	--	--	--	--	--	-5.60E-03	--	--
Co-60	1.37E-02	-8.68E-03	1.49E-02	-1.70E-02	-1.80E-03	1.10E-02	2.32E-01	-8.40E-03	4.60E-03
Cs-134	--	6.10E-01	--	--	--	5.60E-02	1.92E-01	3.13E-01	--
Cs-137	4.34E-02	3.07E-01	1.31E-01	1.56E-01	9.60E-02	1.39E-01	9.25E-02	2.54E-01	9.96E-02
Eu-152	2.00E-03	1.85E-02	3.40E-02	3.40E-02	6.30E-02	3.10E-02	4.90E-02	-6.50E-02	3.30E-02
Eu-154	4.80E-02	1.32E-02	-1.60E-02	2.40E-02	1.30E-02	-6.30E-03	3.30E-03	6.70E-03	-1.80E-02
Eu-155	6.06E-02	4.70E-03	-6.50E-03	5.86E-02	3.70E-02	2.60E-02	--	1.80E-02	5.20E-02
I-129	--	3.21E-01	--	--	--	--	--	--	--
K-40	--	1.04E+01	--	--	--	--	-5.10E-02	--	--
Nb-95	-2.90E-03	1.05E-01	2.80E-03	-2.30E-02	2.90E-02	-1.30E-02	--	-2.20E-02	-2.60E-02
Pb-212	--	1.10E-01	--	--	--	--	--	--	--
Pb-214	--	6.68E-02	--	--	--	--	--	--	--
Pu-238	--	1.47E-04	--	--	--	--	--	--	--
Pu-239	--	3.17E-03	--	--	--	--	1.70E-03	--	--
Ru-103	--	2.46E-01	3.95E-02	--	--	8.95E-02	2.06E-01	1.90E-01	--
Ru-106	--	--	--	--	--	--	--	--	--
Sr-90	1.70E-01	2.16E-01	--	--	4.90E-02	--	4.54E-01	--	1.80E-01
Tc-99	--	9.33E-01	--	--	--	--	--	--	--
Zr-95	1.48E-02	-1.00E-03	1.50E-02	3.32E-02	1.10E-02	4.90E-02	6.35E-02	-2.70E-03	-2.90E-02

[a] All values are averages for each year with a detection since 1985.
A dashed line (--) indicates where no data are available.

Table 4-11. Summary of Air Monitoring Results (pCi/m^3).

Radionuclide	Site						
	N116[a/]	N157[a/]	N159[a/]	N957[a/]	N967[a/]	N968[a/]	N973[a/]
Sr-90	5.89E-04	2.95E-04	9.80E-04	1.26E-03	6.46E-04	5.05E-04	8.95E-04
Cs-137	9.94E-04	2.21E-02	1.65E-02	1.19E-03	4.14E-03	1.15E-03	4.85E-03
Pu-239	4.54E-05	3.49E-05	1.03E-04	2.48E-05	2.36E-05	3.82E-05	2.93E-04
U (Total)	2.52E-04	1.59E-04	1.43E-04	2.07E-04	1.21E-04	2.05E-04	1.39E-04

[a/] All values are averages for each year with a detection since 1985.

Table 4-12. Summary of Surface Water Sampling (pCi/mL).

Radionuclide	1985 Result	1985 Error	1986 Result	1986 Error	1986 Result	1986 Error	1988 Result	1988 Error	1989 Result	1989 Error
Location RM18: 216-B-63 Ditch										
Total beta	Max 1.70E+00 Min. 2.70E-02 Avg. 233E-01	9.22E-01	3.76E-01 <2.4E-02		<9.8E-02 <DL		<DL <DL		6.60E-02 <DL	
Total alpha	Max 1.20E-02 Min 1.00E-03 Avg. 4.00E-03	6.00E-03	<1.1E-02 <DL		<4.0E-03 <DL		2.90E-02 <DL		7.00E-03 <DL	
Cs-137	Max 6.30E-01 Min 4.20E-02 Avg. 1.05E-01	3.23E-01	2.00E-01 <DL		1.70E-01 <DL		1.49E-01 <DL		1.07E-01 <DL	
Sr-90	Max 1.26E+00 Min 1.40E-02 Avg. 1.40E-01	6.79E-01	1.66E-01 <DL		<2.8E-02 <DL		<DL <DL		2.80E-02 <DL	
Location RM21: 216-B-3-3 Ditch										
Total beta	Max 4.20E-01 Min 7.00E-03 Avg. 6.50E-02	2.34E-01	7.56E-01 <2.2E-02		1.55E-01 <DL		1.91E-01 <DL		2.25E-01 <DL	
Total alpha	Max 1.20E-02 Min 1.00E-03 Avg. 3.00E-03	6.00E-03	2.20E-02 <DL		5.20E-02 <DL		<DL <DL		3.80E-02 <DL	
Cs-137	Max 5.60E-02 Min 4.30E-02 Avg. 4.70E-02	8.00E-03	<7.0E-02 <DL		<5.5E-02 <DL		<DL <DL		6.40E-02 <DL	
Sr-90	Max 5.00E-02 Min 1.80E-02 Avg. 3.10E-02	2.00E-02	5.30E-02 <DL		<4.0E-02 <DL		<DL 1.40E-02		2.60E-02 <DL	

Table 4-12. Summary of Surface Water Sampling (pCi/mL).

Radionuclide	1985 Result	1985 Error	1986 Result	1986 Error	1986 Result	1986 Error	1988 Result	1988 Error	1989 Result	1989 Error
Location RM22: 216-B-3 Pond North										
Total beta	Max 1.39E-01		<1.3E-01		<4.4E-02		1.15E-01		1.15E-01	
	Min 1.70E-02		<1.7E-02		<DL		<DL		<DL	
	Avg. 4.50E-02	6.60E-02								
Total alpha	Max 3.00E-02		7.00E-03		1.00E-02		<DL		2.70E-02	
	Min 2.00E-03		<DL		<DL		<DL		<DL	
	Avg. 9.00E-03	2.10E-02								
Cs-137	Max 8.00E-02		<5.6E-02		<6.0E-02		<DL		9.00E-02	
	Min 4.00E-02		<DL		<DL		<DL		<DL	
	Avg. 3.00E-02	2.00E-02								
Sr-90	Max 5.00E-02		5.10E-01		<4.2E-02		<DL		<DL	
	Min 1.60E-02		<DL		<DL		<DL		<DL	
	Avg. 2.80E-02	2.50E-02								
Location RM23: 216-B-3 Pond South										
Total beta	Max 9.50E-02		1.10E-01		<1.1E-01		1.12E-01		2.32E-01	
	Min 1.60E-02		<1.6E-02		<DL		<DL		<DL	
	Avg. 4.20E-02	4.60E-02								
Total alpha	Max 9.00E-03		<8.0E-03		<3.0E-02		5.00E-03		<DL	
	Min 1.00E-03		<DL		<DL		<DL		<DL	
	Avg. 4.00E-03	5.00E-03								
Cs-137	Max 7.40E-02		<8.0E-02		1.43E-01		1.25E-01		6.40E-02	
	Min 4.00E-02		<DL		<DL		<DL		<DL	
	Avg. 4.80E-02	1.90E-02								
Sr-90	Max 2.56E-02		1.09E-01		<4.3E-02		<DL		2.90E-02	
	Min 1.00E-02		<DL		<DL		<DL		<DL	
	Avg. 4.10E-02	1.30E-01								

Table 4-12. Summary of Surface Water Sampling (pCi/mL). Page 3 of 5

Radionuclide	1985 Result	1985 Error	1986 Result	1986 Error	1986 Result	1986 Error	1988 Result	1988 Error	1989 Result	1989 Error
Location RM24: 216-A-25 Pond Inlet										
Total beta	Max 3.80E-01		2.67E-01		5.90E-02					
	Min 1.00E-02		<1.6E-2		<DL					
	Avg. 5.00E-02	2.00E-01								
Total alpha	Max 5.00E-03		<4.0E-03		<1.3E-02					
	Min 1.00E-03		<DL		<DL					
	Avg. 3.00E-03	2.00E-03								
Cs-137	Max 1.20E-01		1.41E-01		<8.0E-02					
	Min 4.30E-02		<DL		3.80E-02					
	Avg. 3.60E-02	4.30E-02								
Sr-90	Max 5.80E-02		<7.2E-02		<1.1E-01					
	Min 1.10E-02		<DL		<DL					
	Avg. 4.00E-02	1.32E-01								
Location RM25: 216-A-25 Pond Outfall										
Total beta	Max 6.60E-02		<3.3E-01		2.60E-01					
	Min 1.30E-02		3.70E-02		4.50E-02					
	Avg. 3.80E-02	3.50E-02								
Total alpha	Max 2.20E-02		<1.0E-02		<1.1E-02					
	Min 1.00E-03		<DL		<DL					
	Avg. 4.00E-03	1.10E-02								
Cs-137	Max 8.00E-02		<9.0E-02		1.40E-01					
	Min 4.20E-02		<DL		<DL					
	Avg. 4.80E-02	1.90E-02								
Sr-90	Max 5.00E-02		8.50E-02		4.50E-02					
	Min 1.50E-02		<1.8E-03		<DL					
	Avg. 2.80E-02	1.90E-02								

Table 4-12. Summary of Surface Water Sampling (pCi/mL).

Radionuclide	1985 Result	1985 Error	1986 Result	1986 Error	1986 Result	1986 Error	1988 Result	1988 Error	1989 Result	1989 Error
Location RM26: 216-B-3 Pond Overflow										
Total beta	Max 6.70E-02		7.40E-02		3.00E-02		1.02E-01		8.20E-02	
	Min 1.20E-02		<1.3E-02		<DL		<DL		<DL	
	Avg. 3.10E-02	3.30E-02								
Total alpha	Max 1.10E-02		3.00E-03		1.00E-02		<DL		2.00E-02	
	Min 1.00E-03		<DL		<DL		<DL		<DL	
	Avg. 4.00E-03	5.00E-03								
Cs-137	Max 1.16E-01		<6.4E-02		<8.7E-02		<DL		6.40E-02	
	Min 3.80E-02		<DL		<DL		<DL		<DL	
	Avg. 5.40E-02	4.30E-02								
Sr-90	Max 2.69E-01		<4.5E-02		<3.03-02		<DL		2.70E-02	
	Min 1.60E-02		<DL		<DL		<DL		<DL	
	Avg. 4.50E-02	1.38E-01								
Location RM29: 216-B-3 Pond 3rd OF										
Total beta	Max 4.40E-02		1.42E-01		<5.9E-02		1.00E-01		1.14E-01	
	Min 2.10E-02		<1.4E-02		<DL		<DL		<DL	
	Avg. 2.90E-02	2.00E-02								
Total alpha	Max 3.00E-03		4.10E-02		<1.4E-02		5.00E-03		2.40E-02	
	Min 2.00E-03		<DL		<DL		<DL		<DL	
	Avg. 2.00E-03	1.00E-03								
Cs-137	Max 6.10E-02		<6.3E-02		<5.7E-02		8.70E-02		6.30E-02	
	Min 4.30E-02		<DL		<DL		<DL		<DL	
	Avg. 4.90E-02	1.70E-02								
Sr-90	Max 8.40E-02		1.14E-01		<4.0E-02		2.70E-02		7.80E-02	
	Min 2.70E-02		<DL		<DL		<DL		<DL	
	Avg. 4.30E-02	5.50E-02								

Table 4-12. Summary of Surface Water Sampling (pCi/mL).

Radionuclide	1985 Result	1985 Error	1986 Result	1986 Error	1986 Result	1986 Error	1988 Result	1988 Error	1989 Result	1989 Error
Location RM53: West Lake										
Total beta	Max 5.40E+01		<5.2E-01		5.78E-01		6.42E-01		4.943-01	
	Min 1.90E-01		<1.3E-01		3.20E-01		1.80E-02		<DL	
	Avg. 1.37E+01	5.33E+01								
Total alpha	Max 6.20E+00		<1.9E-01		1.32E-01		1.14E-01		1.00E-01	
	Min 4.00E-02		<DL		3.90E-02		3.00E-03		<DL	
	Avg. 1.59E+00	6.14E+00								
Cs-137	Max 5.30E-02		<DL		<4.4E-02		<DL		6.00E-02	
	Min 4.00E-02		<DL		<DL		0.00E+00		<DL	
	Avg. 4.10E-02	7.00E-03								
Sr-90	Max 2.00E-02		<3.0E-02		<2.0E-02		<DL		<DL	
	Min 1.00E-02		<DL		<DL		<DL		<DL	
	Avg. 1.30E-02	8.00E-03								

Shading indicates positive detection (result greater than error)
No samples collected in 1988 and 1989
Source: Elder et al. 1985, 1986, 1987, 1988, and 1989
DL: Detection Limit

Table 4-13. Summary of Single-Shell Tank Waste Sampling Data.

Tank	Description	Date	Pu (g/g)	^{137}Cs (μCi/g)	$^{89,90}Sr$ (μCi/g)	^{154}Eu (μCi/g)	Bulk Density (g/cm^3)
B-101	Sludge	3-15-73	--	9.9×10^2	1.92×10^4	0.56×10^2	2.38
B-101	Liquid	3-15-73	--	1.77×10^2	14.5	0.88	--
B-101	Sludge	2-24-76	1.21×10^{-5}	4.21×10^2	1.57×10^3	--	1.59
B-104	Salt crystals	5-22-73	--	0.3	--	--	--
B-105	Solids	6-9-76	--	0.64	5.9	--	1.10
B-107	Sludge	4-8-76	2.73×10^{-6}	3.2	12.9	0.4	1.64
B-201	Solid	--	5.00×10^{-5}	0.109	2.70	--	1.37
B-202	Solid	--	5.50×10^{-6}	0.15	1.01×10^3	--	1.25
B-203	Solid	--	9.01×10^{-6}	0.009	6.54	--	1.09
B-203	Solid	12-30-82	1.17×10^{-6}	0.03	13.12	--	--
B-204	Solid	--	9.74×10^{-6}	0.012	4.00	--	1.14
BX-101	Sludge	3-8-76	0.86×10^{-6}	7.14×10^2	1.07×10^3	--	1.68
BX-107	Solid	7-25-79	1.75×10^{-6}	11.14	14.20	--	1.46
BX-110	Solid	2-14-79	2.13×10^{-6}	47.3	7.8	--	1.44
BY-104	Sludge	3-16-76	0.70×10^{-6}	2.73×10^2	1.08×10^2	--	1.61
BY-104	Liquid	3-16-76	--	36.6	0.14	--	1.45
BY-106	Liquid	4-13-72	--	2.38×10^2		--	1.415
BY-112	Top solids	4-4-72	--	1.51×10^2	34.2	--	1.48
BY-112	Bottom solids	4-4-72	--	20.6	40.3	--	1.44
BY-112	Liquid	4-4-72	--	4.83×10^2	0.27	--	1.42

Table 4-14. Evaluation of Potential Groundwater Contamination.

Waste Management Unit[a]	Range of Soil Column Pore Volumes (m^3)[b]	Liquid Effluent Volume Received (m^3)	Potential Migration to Unconfined Aquifer
Cribs and Drains			
216-B-7A/7B Crib	186 to 558	43,600	Yes
216-B-8TF Crib	17,580 to 52,730	27,200	Yes[c]
216-B-9TF Crib	8,660 to 25,990	36,000	Yes
216-B-10A Crib	155 to 465	9,990	Yes
216-B-10B Crib	155 to 465	28	No
216-B-12 Crib	6,100 to 18,300	520,000	Yes
216-B-13 French Drain	39 to 118	21	No
216-B-14 Crib	5,890 to 17,670	8,710	Yes[c]
216-B-15 Crib	5,890 to 17,670	6,320	Yes[c]
216-B-16 Crib	5,890 to 17,670	5,600	No
216-B-17 Crib	5,890 to 17,670	3,410	No
216-B-18 Crib	5,890 to 17,670	8,520	Yes[c]
216-B-19 Crib	5,890 to 17,670	6,400	Yes[c]
216-B-43 Crib	3,400 to 10,200	2,120	No
216-B-44 Crib	3,295 to 9,885	5,600	Yes[c]
216-B-45 Crib	3,295 to 9,885	4,920	Yes[c]
216-B-46 Crib	3,243 to 9,730	6,700	Yes[c]
216-B-47 Crib	3,452 to 10,355	3,710	Yes[c]
216-B-48 Crib	3,347 to 10,042	4,090	Yes[c]
216-B-49 Crib	3,295 to 9,885	6,700	Yes[c]
216-B-50 Crib	3,295 to 9,885	54,800	Yes

Table 4-14. Evaluation of Potential Groundwater Contamination.

Waste Management Unit[a]	Range of Soil Column Pore Volumes (m^3)[b]	Liquid Effluent Volume Received (m^3)	Potential Migration to Unconfined Aquifer
216-B-51 French Drain	45 to 135	1	No
216-B-55 Crib	6,073 to 18,220	1,230,000	Yes
216-B-57 Crib	1,925 to 5,775	84,400	Yes
216-B-60 Crib	146 to 438	18.9	No
216-B-62 Crib	3,860 to 11,580	282,000	Yes
Reverse Wells			
216-B-4 Reverse Well	0.8 to 2.3	10	Yes
216-B-5 Reverse Well[d]		30,600	Yes[d]
216-B-6 Reverse Well	0.5 to 1.4	6,000	Yes
216-B-11A and 216-B-11B Reverse Wells	56.4 to 169.2	29,600	Yes
Ponds, Ditches, and Trenches			
216-A-25 Pond	229,870 to 689,620	307,000,000	Yes
216-B-3 Pond	760,840 to 2,282,510	240,000,000	Yes
216-B-2-1 Ditch	37,120 to 111,360	149,000,000	Yes
216-B-2-2 Ditch	24,600 to 73,800	49,700	Yes[c]
216-B-3-1 Ditch	8,037 to 24,111	149,000,000	Yes
216-B-3-2 Ditch	23,230 to 69,700	149,000,000	Yes
216-B-20 Trench	4,560 to 13,670	4,680	Yes[c]
216-B-21 Trench	4,650 to 13,950	4,670	Yes[c]
216-B-22 Trench	4,600 to 13,800	4,740	Yes[c]
216-B-23 Trench	4,465 to 13,390	4,520	Yes[c]

Table 4-14. Evaluation of Potential Groundwater Contamination. Page 3 of 4

Waste Management Unit[a]	Range of Soil Column Pore Volumes (m^3)[b]	Liquid Effluent Volume Received (m^3)	Potential Migration to Unconfined Aquifer
216-B-24 Trench	4,560 to 13,670	4,700	Yes[c]
216-B-25 Trench	4,420 to 13,260	3,760	No
216-B-26 Trench	4,465 to 13,390	5,880	Yes[c]
216-B-27 Trench	4,465 to 13,390	4,420	No
216-B-28 Trench	4,510 to 13,530	5,050	Yes[c]
216-B-29 Trench	4,510 to 13,530	4,840	Yes[c]
216-B-30 Trench	4,510 to 13,530	4,780	Yes[c]
216-B-31 Trench	4,510 to 13,530	4,740	Yes[c]
216-B-32 Trench	4,510 to 13,530	4,770	Yes[c]
216-B-33 Trench	4,510 to 13,530	4,740	Yes[c]
216-B-34 Trench	4,510 to 13,530	4,870	Yes[c]
216-B-35 Trench	1,730 to 5,190	1,060	No
216-B-36 Trench	1,730 to 5,190	1,940	Yes[c]
216-B-37 Trench	1,710 to 5,130	4,320	Yes[c]
216-B-38 Trench	1,685 to 5,055	1,430	No
216-B-39 Trench	1,685 to 5,055	1,540	No
216-B-40 Trench	1,640 to 4,920	1,640	Yes[c]
216-B-41 Trench	1,640 to 4,920	1,440	No
216-B-42 Trench	1,755 to 5,265	1,500	No
216-B-52 Trench	5,240 to 15,710	8,530	Yes[c]
216-B-53A Trench	543 to 1,630	549	Yes[c]
216-B-53B Trench	1,370 to 4,120	15.1	No

Table 4-14. Evaluation of Potential Groundwater Contamination. Page 4 of 4

Waste Management Unit[a]	Range of Soil Column Pore Volumes (m^3)[b]	Liquid Effluent Volume Received (m^3)	Potential Migration to Unconfined Aquifer
216-B-54 Trench	1,823 to 5,470	999	No
216-B-58 Trench	1,880 to 5,640	413	No
216-B-63 Trench	3,650 to 10,940	7,200,000	Yes

a/ Waste Management Units 2101-M Pond, 216-N-8 Pond, 216-B-3A Pond, 216-B-3B Pond, 216-B-3C Pond, 216-B-2-3 Ditch, and 216-B-3-3 Ditch are omitted here due to a lack of available inventory data. Waste Management Units 216-B-56 Crib, 216-B-61 Crib, and 216-E-28 Pond were never used and are also omitted.

b/ Pore volume calculation: = (waste unit plan area) x (nominal depth to groundwater) x (porosity). The lower pore volume value reflects 0.10 porosity; the higher pore volume value reflects 0.30 porosity. The pore volume calculation does not account for the ability of the soil to retain the liquid discharged.

c/ The effluent volume received by these units exceeds the lower pore volume estimate but is below the high estimate. Given the high permeability of the soil column in general, it is likely that some of the discharged waste volume reached groundwater.

d/ The 216-B-5 Reverse Well physically extended 6 m below the water table.

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Curies	B-102 Curies	B-103 Curies	B-104 Curies	B-105 Curies	B-106 Curies	B-107 Curies	B-108 Curies
1. Ac225	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08
2. Ac227	3E-05	9E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
3. Am241	1E+02	1E+01	7E+01	4E+00	4E-01	2E-01	1E+00	5E+00
4. Am242	9E-31	4E-04	3E-02	3E-05	3E-05	4E-04	4E-05	1E-02
5. Am242m	9E-31	4E-04	3E-02	3E-05	3E-05	3E-04	4E-05	1E-02
6. Am243	3E-31	3E-04	1E-02	4E-05	5E-06	2E-04	1E-05	7E-03
7. At217	2E-08	1E-08	1E-08	3E-09	2E-08	2E-09	2E-08	2E-08
8. Ba135m	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
9. Ba137m	1E-25	2E+03	1E+04	4E+03	4E+04	2E+03	4E+04	3E+04
10. Bi210	3E-10	4E-11	5E-11	2E-11	1E-11	9E-12	6E-11	2E-10
11. Bi211	3E-05	9E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
12. Bi213	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08
13. Bi214	2E-09	2E-10	3E-10	7E-11	3E-11	4E-11	2E-10	1E-09
14. C14	5E+00	1E+00	3E+00	4E-01	1E+01	5E-01	1E+01	1E+01
15. Cm242	7E-31	4E-04	3E-02	3E-05	2E-05	3E-04	3E-05	9E-03
16. Cm244	2E-30	2E-03	2E-02	4E-06	2E-04	1E-03	4E-03	1E-01
17. Cm245	1E-34	1E-07	1E-06	8E-11	4E-09	8E-08	1E-07	6E-06
18. Cs135	3E-31	3E-02	7E-02	9E-02	6E-01	2E-02	2E-01	1E-01
19. Cs137	1E-25	3E+03	1E+04	5E+03	4E+04	2E+03	5E+04	3E+04
20. Fr221	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Curies	B-102 Curies	B-103 Curies	B-104 Curies	B-105 Curies	B-106 Curies	B-107 Curies	B-108 Curies
21. Fr223	5E-07	1E-07	3E-07	1E-07	1E-06	1E-07	5E-07	2E-06
22. I129	3E-31	1E-03	8E-03	3E-03	2E-02	1E-03	2E-02	4E-02
23. Nb93m	3E+01	7E-01	2E+00	4E-01	1E-01	7E-03	5E-01	3E-01
24. Ni59	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
25. Ni63	3E+02	1E+02	7E+02	1E+01	3E+02	1E+01	7E+01	3E+00
26. Np237	5E-04	3E-03	2E-02	6E-03	5E-02	2E-03	6E-02	8E-02
27. Np239	3E-31	2E-04	1E-02	4E-05	5E-06	2E-04	1E-05	7E-03
28. Pa231	1E-04	2E-05	5E-05	2E-05	1E-04	2E-05	8E-05	3E-04
29. Pa233	5E-04	3E-03	2E-02	6E-03	5E-02	2E-03	6E-02	8E-02
30. Pa234m	7E+00	7E-01	2E+00	3E-01	2E-01	3E-01	2E+00	8E+00
31. Pb209	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08
32. Pb210	3E-10	3E-11	5E-11	2E-11	9E-12	9E-12	6E-11	2E-10
33. Pb211	3E-05	9E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
34. Pb214	2E-09	2E-10	3E-10	7E-11	3E-11	4E-11	2E-10	1E-09
35. Pd107	4E-31	2E-03	1E-02	3E-03	2E-02	1E-03	3E-02	7E-02
36. Po210	3E-10	3E-11	5E-11	2E-11	9E-12	8E-12	6E-11	2E-10
37. Po213	2E-08	1E-08	1E-08	3E-09	2E-08	2E-09	2E-08	2E-08
38. Po214	3E-09	3E-10	3E-10	9E-11	4E-11	4E-11	3E-10	1E-09
39. Po215	3E-05	9E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
40. Po218	2E-09	2E-10	3E-10	7E-11	3E-11	4E-11	2E-10	1E-09

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Curies	B-102 Curies	B-103 Curies	B-104 Curies	B-105 Curies	B-106 Curies	B-107 Curies	B-108 Curies
41. Pu238	3E+01	4E+00	5E+00	2E-01	2E-02	4E-03	9E-02	2E-02
42. Pu239	5E+02	5E+01	2E+02	1E+02	1E+01	1E+00	4E+01	4E+00
43. Pu240	2E+02	1E+01	5E+01	1E+01	1E+00	1E-01	3E+00	3E-01
44. Pu241	3E+03	3E+02	6E+02	2E+01	2E+00	2E-01	5E+00	5E-01
45. Ra223	3E-05	8E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
46. Ra225	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08
47. Ra226	2E-09	2E-10	3E-10	7E-11	3E-11	4E-11	2E-10	1E-09
48. Ru106	4E+00	1E-01	2E-02	3E-08	5E-09	5E-08	1E-07	1E-05
49. Sb126	8E+00	2E-01	7E-01	6E-02	6E-03	7E-04	6E-02	6E-03
50. Sb126m	8E+00	2E-01	7E-01	6E-02	6E-03	7E-04	6E-02	6E-03
51. Se79	5E-30	3E-02	1E-01	5E-02	4E-01	2E-02	4E-01	7E-01
52. Sm151	7E+03	2E+02	7E+02	1E+02	1E+01	1E+00	2E+02	2E+01
53. Sn126	7E+00	2E-01	7E-01	6E-02	6E-03	7E-04	6E-02	6E-03
54. Sr90	5E-26	3E+02	9E+03	8E+03	1E+03	1E+02	2E+04	5E+04
55. Tc99	2E-28	9E-01	5E+00	2E+00	1E+01	7E-01	1E+01	3E+01
56. Th227	3E-05	8E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
57. Th229	2E-08	1E-08	2E-08	3E-09	2E-08	2E-09	2E-08	2E-08
58. Th230	6E-07	6E-08	7E-08	1E-08	5E-09	6E-09	4E-08	2E-07
59. Th231	3E-01	4E-02	8E-02	1E-02	8E-03	1E-02	8E-02	4E-01
60. Th233	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Curies	B-102 Curies	B-103 Curies	B-104 Curies	B-105 Curies	B-106 Curies	B-107 Curies	B-108 Curies
61. Th234	7E+00	7E-01	2E+00	3E-01	2E-01	3E-01	2E+00	8E+00
62. Tl207	3E-05	9E-06	2E-05	1E-05	1E-04	8E-06	4E-05	1E-04
63. U233	7E-06	6E-06	8E-06	1E-06	1E-05	6E-07	1E-05	1E-05
64. U234	5E-03	5E-04	6E-04	7E-05	3E-05	3E-05	2E-04	1E-03
65. U235	3E-01	4E-02	8E-02	1E-02	8E-03	1E-02	9E-02	4E-01
66. U238	7E+00	8E-01	2E+00	3E-01	2E-01	3E-01	2E+00	8E+00
67. Y90	6E-26	3E+02	1E+04	8E+03	1E+03	1E+02	2E+04	5E+04
68. Zr93	4E+01	1E+00	3E+00	4E-01	4E-02	5E-03	4E-01	4E-02
TOT CURIES	1.13E+04	6.29E+03	4.14E+04	2.52E+04	8.25E+04	4.24E+03	1.31E+05	1.60E+05
TOTAL TRU	635.0	65.6	275.2	104.6	20.5	1.8	54.2	19.2

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Moles	B-102 Moles	B-103 Moles	B-104 Moles	B-105 Moles	B-105 Moles	B-107 Moles	B-108 Moles
69. Ag	2E-35	1E-07	6E-07	2E-07	2E-06	9E-08	2E-06	3E-06
70. Al	1E+03	2E+04	1E+05	7E+04	6E+03	1E+04	3E+05	3E+05
71. Ba	1E+02	9E+00	6E+00	9E-01	7E+00	5E-01	8E+00	6E+00
72. Bi	4E-13	3E-13	4E-13	6E+06	6E+05	7E+04	7E+04	7E+03
73. $C_2H_3O_3$	0E+00	0E+00	4E+02	0E+00	0E+00	0E+00	0E+00	0E+00
74. $C_6H_5O_7$	2E-05	2E+04	3E+04	0E+00	0E+00	1E+04	0E+00	2E+04
75. CO_3	3E+05	1E+05	1E+05	2E+05	1E+06	5E+04	1E+05	7E+04
76. C_2O_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
77. Ca	4E+02	2E+01	2E+00	0E+00	0E+00	5E-04	0E+00	2E-04
78. Cd	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
79. Ce	9E-31	1E+00	3E+00	7E+01	5E+00	6E-01	3E+01	7E+00
80. Cl	5E-35	2E-05	3E-05	8E-05	5E-04	2E-05	2E-05	2E-05
81. Cr	7E+03	3E+02	4E+01	2E+04	2E+03	2E+02	1E+04	1E+03
82. EDTA	0E+00	0E+00	6E+02	0E+00	0E+00	0E+00	0E+00	0E+00
83. F	9E-28	4E+02	2E+03	4E+05	8E+05	7E+04	7E+05	2E+06
84. Fe	8E+04	9E+04	1E+04	3E+05	3E+04	5E+03	2E+05	2E+04
85. $Fe(CN)_6$	9E+01	1E+01	2E+02	0E+00	0E+00	6E-05	3E+01	8E+01
86. HEDTA	0E+00	0E+00	1E+03	0E+00	0E+00	0E+00	0E+00	1E+00
87. Hg	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
88. K	1E-12	1E-03	6E+02	0E+00	0E+00	1E-03	0E+00	7E+02

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-101 Moles	B-102 Moles	B-103 Moles	B-104 Moles	B-105 Moles	B-105 Moles	B-107 Moles	B-108 Moles
89. La	0E+00	0E+00	7E-14	0E+00	0E+00	0E+00	0E+00	0E+00
90. Mn	6E-08	5E+01	2E+02	0E+00	0E+00	4E+01	0E+00	7E+01
91. NO_2	2E-25	6E+03	4E+04	5E+04	4E+03	3E+03	4E+05	3E+05
92. NO_3	3E-04	2E+05	5E+05	8E+05	3E+06	7E+05	4E+06	4E+06
93. Na	4E+05	4E+05	7E+05	3E+06	1E+07	6E+06	5E+06	1E+07
94. Ni	2E+03	1E+03	1E+03	0E+00	0E+00	2E+02	5E-03	4E-02
95. OH	3E+05	3E+05	2E+05	9E+05	1E+05	2E+04	6E+05	6E+04
96. PO_4	3E-26	9E+03	7E+03	7E+06	2E+06	2E+06	5E+05	1E+06
97. Pb	2E+04	2E+04	1E+04	4E-10	5E-09	2E-03	1E-09	4E-04
98. SeO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
99. SiO_3	6E-08	3E+02	2E+03	1E+04	8E+02	2E+02	1E+04	7E+03
100. Sn	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
101. SO_4	2E+04	4E+04	4E+04	7E+04	4E+05	1E+04	3E+04	2E+04
102. Sr	2E-30	5E-04	6E-01	0E+00	0E+00	4E-04	0E+00	6E+00
103. WO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
104. ZrO	4E+00	5E-01	2E+00	7E+03	7E+02	8E+01	2E+04	2E+03
105. Volume	1E+02	5E+01	9E+01	4E+02	3E+02	1E+02	2E+02	1E+02

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-109 Curies	B-110 Curies	B-111 Curies	B-112 Curies	B-201 Curies	B-202 Curies	B-203 Curies	B-204 Curies
1. Ac225	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
2. Ac227	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
3. Am241	2E+00	1E+03	4E+00	4E+01	0E+00	4E+01	1E-01	1E+00
4. Am242	4E-03	3E+00	2E-04	9E-02	0E+00	0E+00	0E+00	0E+00
5. Am242m	4E-03	4E+00	2E-04	9E-02	0E+00	0E+00	0E+00	0E+00
6. Am243	2E-03	2E+00	5E-05	5E-02	0E+00	0E+00	0E+00	0E+00
7. At217	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
8. Ba135m	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
9. Ba137m	1E+04	6E+04	5E+05	2E+05	0E+00	0E+00	0E+00	0E+00
10. Bi210	6E-11	5E-10	3E-11	5E-11	0E+00	5E-11	1E-13	1E-12
11. Bi211	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
12. Bi213	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	6E-14	6E-13
13. Bi214	3E-10	2E-09	1E-10	2E-10	0E+00	3E-10	5E-13	5E-12
14. C14	7E+00	1E+02	2E+03	8E+01	0E+00	0E+00	0E+00	0E+00
15. Cm242	3E-03	3E+00	2E-04	7E-02	0E+00	0E+00	0E+00	0E+00
16. Cm244	3E-02	1E+01	1E+00	7E-01	0E+00	0E+00	0E+00	0E+00
17. Cm245	2E-06	1E-03	3E-05	5E-05	0E+00	0E+00	0E+00	0E+00
18. Cs135	6E-02	2E-01	2E+00	1E+00	0E+00	0E+00	0E+00	0E+00
19. Cs137	1E+04	6E+04	6E+05	2E+05	0E+00	0E+00	0E+00	0E+00
20. Fr221	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-109 Curies	B-110 Curies	B-111 Curies	B-112 Curies	B-201 Curies	B-202 Curies	B-203 Curies	B-204 Curies
21. Fr223	5E-07	2E-06	1E-05	1E-06	0E+00	3E-07	4E-14	4E-13
22. I129	1E-02	5E-01	5E+00	3E-01	0E+00	0E+00	0E+00	0E+00
23. Nb93m	9E-02	4E+01	4E+01	2E+00	0E+00	0E+00	0E+00	0E+00
24. Ni59	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
25. Ni63	8E+00	2E+03	2E+03	2E+02	0E+00	0E+00	0E+00	0E+00
26. Np237	3E-02	3E-02	1E+01	6E-01	0E+00	2E-04	9E-07	9E-06
27. Np239	2E-03	2E+00	5E-05	5E-02	0E+00	0E+00	0E+00	0E+00
28. Pa231	8E-05	4E-04	1E-03	1E-04	0E+00	7E-05	1E-11	1E-10
29. Pa233	3E-02	3E-02	1E+01	6E-01	0E+00	2E-04	9E-07	9E-06
30. Pa234m	2E+00	7E+00	4E-01	6E-01	0E+00	3E+00	0E+00	0E+00
31. Pb209	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
32. Pb210	6E-11	5E-10	3E-11	5E-11	0E+00	5E-11	1E-13	1E-12
33. Pb211	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
34. Pb214	3E-10	2E-09	1E-10	2E-10	0E+00	3E-10	5E-13	5E-12
35. Pd107	2E-02	9E-01	8E+00	5E-01	0E+00	0E+00	0E+00	0E+00
36. Po210	6E-11	5E-10	3E-11	5E-11	0E+00	5E-11	1E-13	1E-12
37. Po213	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
38. Po214	3E-10	2E-09	1E-10	2E-10	0E+00	3E-10	7E-13	7E-12
39. Po215	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
40. Po218	3E-10	2E-09	1E-10	2E-10	0E+00	3E-10	5E-13	5E-12

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-109 Curies	B-110 Curies	B-111 Curies	B-112 Curies	B-201 Curies	B-202 Curies	B-203 Curies	B-204 Curies
41. Pu238	1E-02	1E+01	2E-01	1E+00	0E+00	4E+00	5E-03	5E-02
42. Pu239	5E-01	2E+02	3E+01	4E+00	0E+00	2E+02	7E-01	7E+00
43. Pu240	4E-02	5E+01	6E+00	6E-01	0E+00	5E+01	1E-01	1E+00
44. Pu241	5E-02	7E+02	3E+01	3E+00	0E+00	5E+02	8E-01	8E+00
45. Ra223	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
46. Ra225	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
47. Ra226	3E-10	2E-09	1E-10	2E-10	0E+00	3E-10	5E-13	5E-12
48. Ru106	4E-06	1E+00	1E-04	1E-04	0E+00	0E+00	0E+00	0E+00
49. Sb126	8E-04	1E+01	1E-02	2E-03	0E+00	0E+00	0E+00	0E+00
50. Sb126m	8E-04	1E+01	1E-02	2E-03	0E+00	0E+00	0E+00	0E+00
51. Se79	3E-01	8E+00	9E+01	6E+00	0E+00	0E+00	0E+00	0E+00
52. Sm151	2E+00	1E+04	2E+01	2E+00	0E+00	0E+00	0E+00	0E+00
53. Sn126	8E-04	1E+01	1E-02	1E-03	0E+00	0E+00	0E+00	0E+00
54. Sr90	5E+03	6E+04	1E-04	1E+05	0E+00	0E+00	0E+00	0E+00
55. Tc99	9E+00	3E+02	3E+03	2E+02	0E+00	0E+00	0E+00	0E+00
56. Th227	3E-05	2E-04	7E-04	9E-05	0E+00	2E-05	3E-12	3E-11
57. Th229	2E-08	5E-09	1E-06	4E-08	0E+00	7E-11	5E-14	5E-13
58. Th230	4E-08	3E-07	1E-08	2E-08	0E+00	7E-08	1E-10	1E-09
59. Th231	9E-02	3E-01	2E-02	2E-02	0E+00	1E-01	2E-08	2E-07
60. Th233	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00

Total (1/1/90)	B-109 Curies	B-110 Curies	B-111 Curies	B-112 Curies	B-201 Curies	B-202 Curies	B-203 Curies	B-204 Curies
61. Th234	2E+00	7E+00	4E-01	6E-01	0E+00	3E+00	0E+00	0E+00
62. Tl207	3E-05	2E-04	8E-04	1E-04	0E+00	2E-05	3E-12	3E-11
63. U233	1E-05	4E-06	1E-03	4E-05	0E+00	3E-08	6E-11	6E-10
64. U234	2E-04	3E-03	7E-05	2E-04	0E+00	5E-04	6E-07	6E-06
65. U235	9E-02	3E-01	2E-02	3E-02	0E+00	1E-01	2E-08	2E-07
66. U238	2E+00	7E+00	4E-01	6E-01	0E+00	3E+00	0E+00	0E+00
67. Y90	5E+03	6E+04	1E-04	1E+05	0E+00	0E+00	0E+00	0E+00
68. Zr93	5E-03	6E+01	9E-02	9E-03	0E+00	0E+00	0E+00	0E+00
TOT CURIES	3.06E+04	2.63E+05	1.11E+06	6.03E+05	0.00E+00	8.03E+02	1.71E+00	1.71E+01
TOTAL TRU	9.6	1374.5	2144.2	126.5	0.0	244.0	0.8	8.1

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-109 Moles	B-110 Moles	B-111 Moles	B-112 Moles	B-201 Moles	B-202 Moles	B-203 Moles	B-204 Moles
69. Ag	1E-06	3E-05	5E-04	2E-05	0E+00	0E+00	0E+00	0E+00
70. Al	1E+05	3E+05	2E+05	2E+06	0E+00	2E+03	0E+00	0E+00
71. Ba	6E+00	1E+02	3E+01	6E+01	0E+00	8E-01	0E+00	0E+00
72. Bi	8E+02	1E+07	4E+06	4E+05	0E+00	7E+01	7E+02	7E+03
73. $C_2H_3O_3$	2E-01	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
74. $C_6H_5O_7$	7E+03	5E+05	0E+00	2E+05	0E+00	3E+03	0E+00	0E+00
75. CO_3	1E+05	0E+00	2E+06	5E+05	0E+00	0E+00	0E+00	0E+00
76. C_2O_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
77. Ca	1E-01	4E+02	5E-16	1E+02	0E+00	3E+00	0E+00	0E+00
78. Cd	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
79. C_3	4E+00	0E+00	1E-01	5E+01	0E+00	0E+00	0E+00	0E+00
80. Cl	7E-06	0E+00	6E-06	1E-04	0E+00	0E+00	0E+00	0E+00
81. Cr	1E+02	3E+04	8E+03	8E+02	0E+00	9E+01	4E+02	4E+03
82. EDTA	3E-01	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
83. F	1E+06	9E-38	1E+02	7E+04	0E+00	5E+04	5E+04	5E+04
84. Fe	3E+03	6E+05	1E+05	4E+04	0E+00	7E+02	0E+00	0E+00
85. $Fe(CN)_6$	3E+01	0E+00	8E+01	9E+02	0E+00	0E+00	0E+00	0E+00
86. HEDTA	1E+00	0E+00	3E+02	9E+00	0E+00	0E+00	0E+00	0E+00
87. Hg	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
88. K	2E+03	0E+00	3E+04	5E+03	0E+00	4E+04	4E+04	4E+04

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	B-109 Moles	B-110 Moles	B-111 Moles	B-112 Moles	B-201 Moles	B-202 Moles	B-203 Moles	B-204 Moles
89. La	2E-13	0E+00	0E+00	0E+00	0E+00	3E+01	3E+02	3E+03
90. Mn	2E+01	1E+03	1E+02	5E+02	0E+00	8E+01	6E+02	6E+03
91. NO_2	1E+05	0E+00	8E+05	2E+06	0E+00	0E+00	0E+00	0E+00
92. NO_3	5E+05	5E+06	2E+07	7E+06	0E+00	3E+05	2E+05	2E+05
93. Na	8E+06	5E+06	3E+07	5E+06	1E+01	3E+05	3E+05	3E+05
94. Ni	1E-02	7E+03	1E-02	7E+02	0E+00	5E+01	0E+00	0E+00
95. OH	3E+04	1E+06	8E+05	2E+05	1E+01	8E+04	1E+05	1E+05
96. PO_4	2E+06	1E+07	4E+06	4E+05	0E+00	5E+03	5E+03	5E+03
97. Pb	1E-04	5E+00	2E-08	3E-03	0E+00	3E-02	6E-17	6E-16
98. SeO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
99. SiO_3	3E+03	2E-38	1E+04	5E+04	0E+00	0E+00	0E+00	0E+00
100. Sn	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
101. SO_4	8E+03	5E-08	8E+05	1E+05	0E+00	6E+02	7E+02	7E+02
102. Sr	2E+00	2E+00	0E+00	4E+01	0E+00	3E-01	0E+00	0E+00
103. WO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
104. ZrO	3E+02	9E+00	1E-02	6E+00	0E+00	0E+00	0E+00	0E+00
105. Volume	1E+02	6E+02	5E+02	8E+01	3E+01	3E+01	5E+01	5E+01

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Curies	BX-102 Curies	BX-103 Curies	BX-104 Curies	BX-105 Curies	BX-106 Curies	BX-107 Curies	BX-108 Curies	BX-109 Curies	BX-110 Curies	BX-111 Curies	BX-112 Curies
1. Ac225	2E-08	8E-08	3E-08	9E-07	1E-07	3E-07	7E-09	6E-09	2E-08	6E-08	7E-08	6E-09
2. Ac227	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
3. Am241	1E+02	7E+02	2E-03	2E+01	4E+03	3E+03	3E+00	3E-01	3E+01	6E+01	6E+01	3E+00
4. Am242	3E-05	1E+00	2E-06	8E-03	7E+00	4E+00	4E-05	4E-06	5E-02	1E-01	1E-01	6E-03
5. Am242m	3E-05	1E+00	2E-06	8E-03	7E+00	5E+00	4E-05	4E-06	5E-02	1E-01	1E-01	6E-03
6. Am243	1E-04	6E-01	9E-07	3E-03	3E+00	2E+00	9E-05	9E-06	2E-03	9E-02	9E-02	2E-04
7. At217	2E-08	8E-08	3E-08	9E-07	1E-07	3E-07	7E-09	6E-09	2E-08	6E-08	7E-08	6E-09
8. Ba135m	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
9. Ba137m	8E-15	3E+05	9E-13	6E+05	1E+05	6E+06	1E+04	4E+02	1E+04	4E+05	4E+05	7E+03
10. Bi210	1E-10	6E-11	4E-12	5E-11	2E-10	3E-10	5E-11	8E-12	5E-10	6E-11	5E-11	9E-10
11. Bi211	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
12. Bi213	2E-08	8E-08	3E-08	1E-06	1E-07	3E-07	7E-09	6E-09	2E-08	8E-08	7E-08	7E-09
13. Bi214	5E-10	1E-10	7E-12	2E-10	6E-10	7E-10	2E-10	3E-11	1E-09	1E-10	1E-10	4E-09
14. C14	2E+01	6E+02	9E+01	1E+03	8E+02	2E+03	2E-01	8E-02	7E+00	1E+02	1E+02	3E+00
15. Cm242	3E-05	1E+00	2E-06	6E-03	6E+00	4E+00	3E-05	3E-06	4E-02	1E-01	1E-01	5E-03
16. Cm244	3E-19	3E+00	7E-20	2E+00	1E+01	1E+01	2E-05	5E-05	1E-03	1E+00	1E+00	7E-04
17. Cm245	2E-23	2E-04	2E-24	4E-05	9E-04	7E-04	3E-10	1E-09	3E-08	7E-05	7E-05	2E-08
18. Cs135	4E-20	1E+00	9E-18	2E+00	4E-01	2E+01	3E-01	2E-03	1E-01	2E+00	2E+00	5E-02
19. Cs137	9E-15	3E+05	9E-13	6E+05	2E+05	6E+06	1E+04	5E+02	2E+04	4E+05	4E+05	7E+03
20. Fr221	2E-08	8E-08	3E-08	1E-06	1E-07	3E-07	7E-09	6E-09	2E-08	6E-08	7E-08	6E-09

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Curies	BX-102 Curies	BX-103 Curies	BX-104 Curies	BX-105 Curies	BX-106 Curies	BX-107 Curies	BX-108 Curies	BX-109 Curies	BX-110 Curies	BX-111 Curies	BX-112 Curies
21. Fr223	4E-07	3E-06	4E-09	1E-05	6E-06	1E-05	5E-07	3E-08	1E-06	2E-06	2E-06	7E-06
22. I129	1E-19	1E+00	1E-18	5E+00	2E+00	4E+00	8E-03	2E-04	7E-03	5E-01	5E-01	3E-03
23. Nb93M	7E-01	8E+00	5E-08	5E+01	5E+01	5E+01	2E+00	2E-01	2E+01	4E+00	4E+00	3E-01
24. Ni59	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
25. Ni63	4E+02	6E+03	3E+02	1E+03	3E+04	3E+03	5E+01	8E-02	7E+01	2E+01	2E+01	4E+01
26. Np237	6E-04	9E-01	1E-08	1E+01	1E+00	4E+00	2E-02	5E-04	2E-02	9E-01	1E+00	1E-02
27. Np239	1E-04	6E-01	8E-07	3E-03	3E+00	2E+00	9E-05	9E-06	2E-03	8E-02	8E-02	2E-04
28. Pa231	9E-05	4E-04	9E-07	1E-03	8E-04	1E-03	6E-05	5E-06	1E-04	2E-04	2E-04	1E-03
29. Pa233	6E-04	9E-01	1E-08	1E+01	1E+00	4E+00	2E-02	5E-04	2E-02	9E-01	1E+00	1E-02
30. Pa234m	3E+00	4E-02	4E-02	8E-01	5E-02	4E-02	8E-01	1E-01	4E+00	2E-01	1E-01	4E+01
31. Pb209	2E-08	8E-08	3E-08	9E-07	1E-07	3E-07	7E-09	6E-09	2E-08	6E-08	7E-08	6E-09
32. Pb210	9E-11	6E-11	4E-12	5E-11	2E-10	2E-10	5E-11	8E-12	5E-10	5E-11	5E-11	9E-10
33. Pb211	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
34. Pb214	5E-10	1E-10	7E-12	2E-10	6E-10	7E-10	2E-10	3E-11	1E-09	1E-10	1E-10	4E-09
35. Pd107	2E-19	2E+00	8E-19	9E+00	4E+00	6E+00	7E-03	3E-04	1E-02	8E-01	8E-01	5E-03
36. Po210	9E-11	6E-11	4E-12	5E-11	2E-10	3E-10	5E-11	8E-12	5E-10	6E-11	5E-11	9E-10
37. Po213	2E-08	8E-08	3E-08	9E-07	1E-07	3E-07	7E-09	6E-09	2E-08	6E-08	6E-08	6E-09
38. Po214	6E-10	2E-10	8E-12	3E-10	7E-10	9E-10	2E-10	3E-11	2E-09	1E-10	1E-10	5E-09
39. Po215	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
40. Po218	5E-10	1E-10	7E-12	2E-10	6E-10	7E-10	2E-10	3E-11	1E-09	1E-10	1E-10	4E-09

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Curies	BX-102 Curies	BX-103 Curies	BX-104 Curies	BX-105 Curies	BX-106 Curies	BX-107 Curies	BX-108 Curies	BX-109 Curies	BX-110 Curies	BX-111 Curies	BX-112 Curies
41. Pu238	1E+01	1E+00	2E-01	2E+00	9E-01	6E-01	1E-01	1E-02	5E-01	1E-01	4E-02	1E-01
42. Pu239	5E+02	3E+01	2E-04	6E+01	3E-03	2E-03	5E+01	5E+00	6E+01	2E+01	2E+00	1E+01
43. Pu240	1E+02	9E+00	3E-04	2E+01	3E-02	3E-02	4E+00	4E-01	7E+00	2E+00	2E-01	2E+00
44. Pu241	3E+03	2E+02	2E-03	2E+02	2E-03	4E-03	1E+01	1E+00	2E+01	7E+00	7E-01	1E+01
45. Ra223	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
46. Ra225	2E-08	8E-08	3E-08	1E-06	1E-07	3E-07	7E-09	6E-09	2E-08	7E-08	7E-08	6E-09
47. Ra226	5E-10	1E-10	7E-12	2E-10	6E-10	7E-10	2E-10	3E-11	1E-09	1E-10	1E-10	4E-09
48. Ru106	2E-04	6E-04	1E-03	2E-03	5E-03	1E-02	7E-08	7E-09	2E-06	2E-04	2E-04	1E-07
49. Sb126	1E-01	5E-09	3E-08	2E-01	9E-08	6E+00	3E-01	3E-02	3E+00	7E-02	7E-03	6E-02
50. Sb126m	1E-01	5E-09	3E-08	2E-01	9E-08	6E+00	3E-01	3E-02	3E+00	7E-02	7E-03	6E-02
51. Se79	2E-18	2E+01	1E-17	9E+01	4E+01	7E+01	1E-01	3E-03	1E-01	9E+00	9E+00	6E-02
52. Sm151	3E+02	9E-04	4E-03	2E+02	2E-03	7E+03	9E+02	9E+01	7E+03	1E+02	1E+01	7E+01
53. Sn126	1E-01	5E-09	3E-08	2E-01	9E-08	6E+00	3E-01	3E-02	3E+00	7E-02	7E-03	6E-02
54. Sr90	1E-15	1E+05	2E+05	2E+04	4E+06	1E+06	4E+04	5E+03	4E+05	2E+05	2E+05	4E+03
55. Tc99	6E-17	6E+02	4E-16	3E+03	2E+03	2E+03	5E+00	1E-01	4E+00	3E+02	3E+02	2E+00
56. Th227	3E-05	2E-04	2E-07	7E-04	4E-04	8E-04	3E-05	2E-06	8E-05	1E-04	1E-04	5E-04
57. Th229	2E-08	8E-08	3E-08	1E-06	1E-07	3E-07	7E-09	6E-09	2E-08	7E-08	7E-08	6E-09
58. Th230	1E-07	7E-09	2E-09	4E-08	3E-09	1E-08	2E-08	4E-09	2E-07	7E-09	2E-09	7E-07
59. Th231	1E-01	2E-03	2E-03	3E-02	2E-03	2E-03	3E-02	6E-03	2E-01	1E-02	4E-03	2E+00
60. Th233	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Curies	BX-102 Curies	BX-103 Curies	BX-104 Curies	BX-105 Curies	BX-106 Curies	BX-107 Curies	BX-108 Curies	BX-109 Curies	BX-110 Curies	BX-111 Curies	BX-112 Curies
61. Th234	3E+00	4E-02	4E-02	8E-01	5E-02	4E-02	8E-01	1E-01	4E+00	2E-01	1E-01	4E+01
62. Tl207	3E-05	2E-04	3E-07	8E-04	4E-04	8E-04	3E-05	2E-06	9E-05	1E-04	1E-04	5E-04
63. U233	1E-05	8E-05	1E-05	9E-04	1E-04	3E-04	4E-06	2E-06	7E-06	8E-05	8E-05	3E-06
64. U234	1E-03	7E-05	2E-05	3E-04	4E-05	3E-05	1E-04	2E-05	6E-04	4E-05	1E-05	4E-03
65. U235	1E-01	2E-03	2E-03	3E-02	2E-03	2E-03	3E-02	6E-03	2E-01	1E-02	4E-03	2E+00
66. U238	3E+00	4E-02	4E-02	8E-01	5E-02	4E-02	8E-01	1E-01	4E+00	2E-01	1E-01	4E+01
67. Y90	1E-15	1E+15	2E+05	2E+04	4E+06	2E+06	4E+04	5E+03	4E+05	2E+05	2E+05	4E+03
68. Zr93	9E-01	1E-08	6E-08	9E-01	1E-08	9E-10	2E+00	2E-01	2E+01	5E-01	5E-02	4E-01
TOT CURIES	4.44E+03	8.48E+05	4.00E+05	1.25E+06	8.50E+06	1.52E+07	1.01E+05	1.10E+04	8.47E+05	1.22E+06	1.20E+06	2.23E+04
TOTAL TRU	630.0	1345.4	90.2	1092.0	4827.9	4721.6	53.3	5.4	97.7	183.5	163.7	16.1

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Moles	BX-102 Moles	BX-103 Moles	BX-104 Moles	BX-105 Moles	BX-106 Moles	BX-107 Moles	BX-108 Moles	BX-109 Moles	BX-110 Moles	BX-111 Moles	BX-112 Moles
69. Ag	1E-23	8E-05	5E-23	5E-04	2E-04	5E-04	6E-07	2E-08	6E-07	4E-05	4E-05	3E-07
70. Al	1E+06	7E+06	4E+06	5E+05	2E+06	1E+07	1E+05	3E+05	4E+05	3E+06	3E+06	3E+05
71. Ba	3E+00	1E+01	5E+00	3E+01	1E+01	2E+02	3E+00	2E+00	1E+01	2E+01	2E+01	2E+00
72. Bi	5E-13	4E-12	6E-13	1E-11	2E-04	5E-12	7E+04	7E+03	8E+02	5E+04	5E+03	3E+04
73. $C_2H_3O_3$	0E+00	0E+00	0E+00	0E+00	0E+00	4E+03	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
74. $C_6H_5O_7$	6E-13	5E+05	3E-14	0E+00	1E+06	1E+06	0E+00	0E+00	0E+00	3E+05	3E+05	0E+00
75. CO_3	1E+05	8E+05	1E+06	3E+06	4E+05	3E+06	7E+05	4E+03	3E+05	8E+05	9E+05	7E+04
76. C_2O_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
77. Ca	4E+03	4E+02	5E+01	0E+00	1E+01	9E-01	0E+00	1E-07	1E-04	2E-03	4E-03	0E+00
78. Cd	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
79. Ce	7E-20	3E+01	3E-17	2E-03	2E+01	6E+02	1E+02	3E-01	2E-02	7E+01	7E+01	6E+01
80. Cl	2E-24	1E-04	3E-29	1E-07	2E-05	5E-04	2E-04	4E-07	6E-05	2E-04	2E-04	2E-05
81. Cr	3E-01	2E-02	3E-06	2E-05	2E-05	5E+00	1E+04	1E+03	1E+02	7E+03	7E+02	4E+03
82. EDTA	0E+00	0E+00	0E+00	0E+00	0E+00	6E+03	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
83. F	4E-15	7E+04	9E+05	1E+00	6E+04	5E+05	1E+05	2E+04	1E+01	1E+05	1E+05	5E+04
84. Fe	1E+05	1E+05	1E+03	0E+00	2E+05	2E+05	2E+05	2E+04	2E+03	1E+05	5E+04	6E+04
85. $Fe(CN)_6$	2E+01	3E+03	6E+02	9E+00	6E+00	1E+03	0E+00	5E-02	3E+01	1E+03	1E+03	2E-14
86. HEDTA	9E-18	6E+01	5E-23	3E+02	7E+01	1E+04	0E+00	0E+00	0E+00	1E+01	1E+01	0E+00
87. Hg	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
88. K	6E-16	1E+04	3E-21	3E+04	8E+04	4E+05	0E+00	0E+00	0E+00	8E+03	8E+03	0E+00

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BX-101 Moles	BX-102 Moles	BX-103 Moles	BX-104 Moles	BX-105 Moles	BX-106 Moles	BX-107 Moles	BX-108 Moles	BX-109 Moles	BX-110 Moles	BX-111 Moles	BX-112 Moles
89. La	0E+00	0E+00	0E+00	0E+00	0E+00	3E-24	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
90. Mn	2E-15	2E+03	3E+02	2E+02	4E+03	7E+03	0E+00	0E+00	0E+00	8E+02	9E+02	0E+00
91. NO_2	2E-14	2E+06	3E-11	9E+05	2E+05	7E+06	8E+04	8E+03	2E+05	3E+06	3E+06	1E+05
92. NO_3	9E-04	2E+07	5E+07	5E+07	4E+07	1E+08	1E+06	2E+04	1E+06	1E+07	1E+07	1E+06
93. Na	2E+05	2E+07	6E+07	6E+07	5E+07	1E+08	4E+06	4E+04	1E+06	8E+06	9E+06	2E+06
94. Ni	1E+04	2E+04	1E+03	2E+01	4E+04	8E+03	0E+00	6E-13	6E-03	5E-01	5E-01	2E-26
95. OH	4E+06	1E+07	1E+07	3E+06	4E+06	7E+06	6E+05	1E+06	9E+05	1E+06	4E+04	9E+05
96. PO_4	2E-15	2E+04	4E+04	7E+03	2E+05	1E+06	4E+05	8E+03	4E+04	1E+05	3E+05	5E+05
97. Pb	9E+03	1E+04	1E+03	2E-08	8E-02	2E+04	1E-09	6E-11	3E-09	5E-03	5E-03	1E-08
98. SeO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
99. SiO_3	2E-14	2E+06	1E+05	2E+04	5E+04	4E+05	2E+04	2E+02	4E+03	8E+04	8E+04	1E+04
100. Sn	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
101. SO_4	2E+03	2E+05	2E+05	1E+06	3E+05	2E+06	2E+05	4E+02	4E+04	2E+05	2E+05	3E+04
102. Sr	9E-21	3E+02	4E+02	1E+02	1E+03	2E+02	0E+00	0E+00	2E-03	7E+01	7E+01	0E+00
103. WO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
104. ZrO	3E+00	9E+00	2E+01	4E+00	1E+02	6E+01	2E+04	2E+03	3E+02	2E+04	2E+03	9E+03
105. Volume	5E+01	6E+01	8E+02	5E+02	5E+02	1E+03	4E+02	2E+01	2E+02	2E+02	2E+02	1E+02

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Curies	BY-102 Curies	BY-103 Curies	BY-104 Curies	BY-105 Curies	BY-106 Curies	BY-107 Curies	BY-108 Curies	BY-109 Curies	BY-110 Curies	BY-111 Curies	BY-112 Curies
1. Ac225	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
2. Ac227	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-05	3E-05
3. Am241	8E+01	2E+01	2E+02	2E+02	2E+02	1E+02	6E+01	9E+01	3E+01	1E+02	8E+01	1E+01
4. Am242	2E-01	5E-02	3E-02	3E-01	2E-01	2E-01	8E-02	1E-01	6E-02	2E-01	2E-01	3E-02
5. Am242m	2E-01	5E-02	3E-02	3E-01	2E-01	2E-01	8E-02	1E-01	6E-02	2E-01	2E-01	3E-02
6. Am243	1E-01	3E-02	1E-02	2E-01	1E-01	1E-01	6E-02	9E-02	4E-02	1E-01	1E-01	2E-02
7. At217	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
8. Ba135m	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
9. Ba137m	5E+05	1E+05	2E+04	5E+05	4E+05	5E+05	2E+05	2E+05	2E+05	4E+05	5E+05	9E+04
10. Bi210	9E-11	4E-11	2E-10	2E-09	1E-09	3E-10	3E-10	2E-10	2E-11	4E-10	9E-11	1E-11
11. Bi211	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
12. Bi213	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
13. Bi214	1E-10	1E-10	9E-10	9E-09	4E-09	1E-09	1E-09	1E-09	6E-11	1E-09	2E-10	3E-11
14. C14	2E+02	5E+01	1E+01	2E+02	1E+02	2E+02	6E+01	6E+01	5E+01	1E+02	2E+02	3E+01
15. Cm242	1E-01	4E-02	2E-02	3E-01	2E-01	1E-01	6E-02	1E-01	5E-02	1E-01	2E-01	3E-02
16. Cm244	2E+00	4E-01	8E-02	2E+00	1E+00	2E+00	6E-01	9E-01	5E-01	1E+00	2E+00	3E-01
17. Cm245	9E-05	3E-05	5E-06	1E-04	8E-05	1E-04	4E-05	6E-05	3E-05	9E-05	1E-04	2E-05
18. Cs135	2E+00	6E-01	1E-01	2E+00	2E+00	2E+00	7E-01	1E+00	7E-01	2E+00	2E+00	4E-01
19. Cs137	5E+05	1E+05	2E+04	5E+05	4E+05	5E+05	2E+05	2E+05	2E+05	5E+05	5E+05	9E+04
20. Fr221	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Curies	BY-102 Curies	BY-103 Curies	BY-104 Curies	BY-105 Curies	BY-106 Curies	BY-107 Curies	BY-108 Curies	BY-109 Curies	BY-110 Curies	BY-111 Curies	BY-112 Curies
21. Fr223	3E-06	7E-07	6E-07	1E-05	5E-06	3E-06	2E-06	1E-06	8E-07	2E-06	3E-06	5E-07
22. I129	6E-01	2E-01	3E-02	7E-01	5E-01	6E-01	2E-01	3E-01	2E-01	6E-01	7E-01	1E-01
23. Nb93m	5E+00	1E+00	2E+00	4E+01	2E+01	1E+01	8E+00	8E+00	2E+00	1E+01	5E+00	9E-01
24. Ni59	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
25. Ni63	5E+02	7E+02	3E+03	2E+03	2E+03	3E+02	7E+02	1E+03	5E+02	1E+03	8E+02	9E+02
26. Np237	1E+00	4E-01	6E-02	1E+00	1E+00	1E+00	5E-01	7E-01	4E-01	1E+00	1E+00	2E-01
27. Np239	1E-01	3E-02	1E-02	2E-01	1E-01	1E-01	5E-02	9E-02	3E-02	1E-01	1E-01	2E-02
28. Pa231	3E-04	9E-05	1E-04	1E-03	7E-04	3E-04	3E-04	1E-04	1E-04	3E-04	3E-04	5E-05
29. Pa233	1E+00	4E-01	6E-02	1E+00	1E+00	1E+00	5E-01	7E-01	4E-01	1E+00	1E+00	2E-01
30. Pa234m	5E-02	4E-01	5E+00	5E+01	2E+01	2E-01	5E+00	9E-01	3E-01	6E-02	1E+00	5E-02
31. Pb209	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
32. Pb210	9E-11	4E-11	2E-10	2E-09	1E-09	3E-10	3E-10	2E-10	2E-11	3E-10	9E-11	1E-11
33. Pb211	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
34. Pb214	1E-10	1E-10	9E-10	9E-09	4E-09	1E-09	1E-09	1E-09	6E-11	1E-09	2E-10	3E-11
35. Pd107	1E+00	3E-01	5E-02	1E+00	9E-01	1E+00	4E-01	5E-01	3E-01	1E+00	1E+00	2E-01
36. Po210	9E-11	4E-11	2E-10	2E-09	1E-09	3E-10	3E-10	2E-10	2E-11	3E-10	9E-11	1E-11
37. Po213	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
38. Po214	2E-10	1E-10	1E-09	1E-08	5E-09	1E-09	2E-09	1E-09	7E-11	2E-09	4E-10	5E-11
39. Po215	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
40. Po218	1E-10	1E-10	9E-10	9E-09	4E-09	1E-09	1E-09	1E-09	6E-11	1E-09	2E-10	3E-11

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Curies	BY-102 Curies	BY-103 Curies	BY-104 Curies	BY-105 Curies	BY-106 Curies	BY-107 Curies	BY-108 Curies	BY-109 Curies	BY-110 Curies	BY-111 Curies	BY-112 Curies
41. Pu238	1E-01	2E-01	2E+01	4E+01	1E+01	1E+01	7E+00	1E+01	1E-01	1E+01	1E-01	1E-01
42. Pu239	4E-02	4E-03	9E+02	2E+02	9E+01	3E+01	3E+01	3E+01	8E-05	5E+01	2E-01	1E-04
43. Pu240	1E-02	2E-03	2E+02	3E+01	2E+01	6E+00	6E+00	6E+00	2E-03	1E+01	5E-02	2E-03
44. Pu241	2E-02	2E-03	3E+03	1E+02	8E+01	4E+01	3E+01	4E+01	4E-04	6E+01	3E-01	8E-04
45. Ra223	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
46. Ra225	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
47. Ra226	1E-10	1E-10	9E-10	9E-09	4E-09	1E-09	1E-09	1E-09	6E-11	1E-09	2E-10	3E-11
48. Ru106	2E-04	8E-05	2E-02	3E-04	3E-04	2E-04	9E-05	1E-04	7E-05	2E-04	2E-04	4E-05
49. Sb126	2E-03	2E-04	6E-01	6E+00	5E+00	1E+00	1E+00	2E+00	2E-08	2E+00	1E-02	1E-08
50. Sb126m	2E-03	2E-04	6E-01	6E+00	5E+00	1E+00	1E+00	2E+00	2E-08	2E+00	1E-02	1E-08
51. Se79	1E+01	3E+00	6E-01	1E+01	1E+01	1E+01	4E+00	5E+00	4E+00	1E+01	1E+01	2E+00
52. Sm151	4E+00	4E-01	6E+02	9E+03	6E+03	2E+03	2E+03	2E+03	1E-03	3E+03	1E+01	1E-03
53. Sn126	2E-03	2E-04	5E-01	6E+00	4E+00	1E+00	1E+00	1E+00	2E-08	2E+00	1E-02	1E-08
54. Sr90	4E+05	1E+05	7E+05	3E+05	2E+05	4E+05	2E+05	5E+04	1E+05	3E+05	4E+05	7E+04
55. Tc99	4E+02	1E+02	2E+01	4E+02	3E+02	4E+02	2E+02	2E+02	1E+02	4E+02	4E+02	8E+01
56. Th227	2E-04	5E-05	4E-05	7E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
57. Th229	1E-07	5E-08	8E-08	1E-07	1E-07	1E-07	7E-08	7E-08	5E-08	1E-07	1E-07	6E-08
58. Th230	2E-09	2E-08	2E-07	2E-06	6E-07	2E-07	2E-07	2E-07	4E-09	2E-07	2E-08	3E-09
59. Th231	2E-03	2E-02	2E-01	2E+00	8E-01	1E-02	2E-01	4E-02	1E-02	3E-03	5E-02	2E-03
60. Th233	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Curies	BY-102 Curies	BY-103 Curies	BY-104 Curies	BY-105 Curies	BY-106 Curies	BY-107 Curies	BY-108 Curies	BY-109 Curies	BY-110 Curies	BY-111 Curies	BY-112 Curies
61. Th234	5E-02	4E-01	5E+00	5E+01	2E+01	2E-01	5E+00	9E-01	3E-01	6E-02	1E+00	5E-02
62. Tl207	2E-04	5E-05	4E-05	8E-04	3E-04	2E-04	1E-04	9E-05	6E-05	2E-04	2E-04	3E-05
63. U233	1E-04	4E-05	4E-05	1E-04	1E-04	1E-04	6E-05	7E-05	5E-05	1E-04	1E-04	5E-05
64. U234	2E-05	1E-04	2E-03	1E-02	3E-03	1E-03	1E-03	1E-03	4E-05	1E-03	1E-04	2E-05
65. U235	2E-03	2E-02	2E-01	2E+00	8E-01	1E-02	2E-01	4E-02	1E-02	3E-03	5E-02	2E-03
66. U238	5E-02	4E-01	5E+00	5E+01	2E+01	2E-01	5E+00	9E-01	3E-01	6E-02	1E+00	5E-02
67. Y90	4E+05	1E+05	7E+05	3E+05	2E+05	4E+05	2E+05	5E+04	1E+05	4E+05	4E+05	7E+04
68. Zr93	1E-02	1E-03	3E+00	4E+01	3E+01	9E+00	7E+00	9E+00	0E+00	1E+01	8E-02	1E-08
TOT CURIES	1.72E+06	4.81E+05	1.47E+06	1.61E+06	1.23E+06	1.76E+06	7.03E+05	5.03E+05	6.01E+05	1.56E+06	1.70E+06	3.21E+05
TOTAL TRU	281.9	70.8	1137.2	626.2	359.8	361.8	157.9	191.7	80.7	281.8	284.3	40.4

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Moles	BY-102 Moles	BY-103 Moles	BY-104 Moles	BY-105 Moles	BY-106 Moles	BY-107 Moles	BY-108 Moles	BY-109 Moles	BY-110 Moles	BY-111 Moles	BY-112 Moles
69. Ag	5E-05	1E-05	2E-06	5E-05	4E-05	5E-05	2E-05	3E-05	2E-05	5E-05	5E-05	1E-05
70. Al	4E+06	2E+06	4E+06	4E+06	5E+06	5E+06	2E+06	2E+06	2E+06	4E+06	5E+06	4E+06
71. Ba	4E+01	1E+01	2E+01	4E+01	3E+01	3E+01	1E+01	2E+01	1E+01	3E+01	3E+01	1E+01
72. Bi	2E-12	2E-12	4E-04	5E+04	3E+04	1E-06	1E+04	1E+03	1E-05	1E+04	4E-12	9E-05
73. $C_2H_3O_3$	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
74. $C_6H_5O_7$	3E+05	1E+05	2E+04	4E+05	3E+05	3E+05	1E+05	2E+05	1E+05	3E+05	4E+05	6E+04
75. CO_3	1E+06	3E+05	1E+05	3E+06	2E+06	1E+06	6E+05	7E+05	4E+05	1E+06	1E+06	2E+05
76. C_2O_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
77. Ca	5E-03	2E-02	4E-01	7E+04	1E+05	2E+04	7E+03	1E+04	2E-02	1E+04	4E-03	8E-03
78. Cd	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
79. Ce	9E+01	3E+01	5E+00	1E+02	7E+01	1E+02	3E+01	5E+01	3E+01	9E+01	1E+02	2E+01
80. Cl	3E-04	8E-05	1E-05	3E-04	2E-04	3E-04	1E-04	2E-04	9E-05	2E-04	3E-04	5E-05
81. Cr	6E-13	2E-12	5E-05	6E+03	5E+03	1E-07	2E+03	2E+02	1E-06	2E+03	1E-12	1E-05
82. EDTA	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
83. F	1E+05	1E+06	4E+06	1E+05	1E+05	1E+05	5E+04	9E+04	2E+05	1E+05	1E+05	4E+04
84. Fe	6E+04	2E+04	3E+03	2E+05	1E+05	6E+04	5E+04	4E+04	2E+04	8E+04	6E+04	1E+04
85. $Fe(CN)_6$	1E+03	4E+02	2E+03	1E+05	7E+04	3E+04	3E+04	3E+04	4E+02	5E+04	2E+03	2E+03
86. HEDTA	2E+01	5E+00	9E-01	2E+01	1E+01	2E+01	7E+00	1E+01	6E+00	2E+01	2E+01	3E+00
87. Hg	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
88. K	1E+04	3E+03	5E+02	1E+04	8E+03	1E+04	4E+03	7E+03	3E+03	1E+04	1E+04	2E+03

Table 4-15. TRAC Inventory Data.

Total (1/1/90)	BY-101 Moles	BY-102 Moles	BY-103 Moles	BY-104 Moles	BY-105 Moles	BY-106 Moles	BY-107 Moles	BY-108 Moles	BY-109 Moles	BY-110 Moles	BY-111 Moles	BY-112 Moles
89. La	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
90. Mn	1E+03	3E+02	6E+01	1E+03	9E+02	1E+03	4E+02	7E+02	4E+02	1E+03	1E+03	2E+02
91. NO_2	4E+06	1E+06	2E+05	4E+06	3E+06	4E+06	2E+06	2E+06	1E+06	4E+06	4E+06	8E+05
92. NO_3	2E+07	3E+07	8E+07	2E+07	1E+07	2E+07	6E+06	9E+06	3E+07	1E+07	2E+07	1E+07
93. Na	2E+07	3E+07	9E+07	1E+07	1E+07	1E+07	4E+06	8E+06	3E+07	1E+07	1E+07	1E+07
94. Ni	3E+00	1E+02	3E+03	2E+05	1E+05	6E+04	6E+04	6E+04	2E+02	9E+04	3E+03	4E+03
95. OH	1E+06	5E+06	1E+07	5E+05	7E+06	4E+06	2E+06	4E+05	4E+06	3E+05	2E+06	8E+06
96. PO_4	5E+05	2E+04	1E+06	7E+04	1E+05	6E+04	3E+04	4E+04	2E+04	6E+04	6E+04	5E+04
97. Pb	2E-02	1E+00	2E+03	7E-03	7E-03	7E-03	3E-03	5E-03	9E-01	6E-03	7E-03	1E-03
98. SeO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
99. SiO_3	1E+05	3E+04	6E+03	1E+05	1E+05	1E+05	4E+04	6E+04	4E+04	1E+05	1E+05	2E+04
100. Sn	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
101. SO_4	3E+05	8E+04	8E+04	3E+05	2E+05	3E+05	1E+05	1E+05	9E+04	3E+05	3E+05	5E+04
102. Sr	9E+01	5E+03	6E+04	9E+01	3E+03	3E+04	2E+04	1E+03	3E+03	3E+04	2E+03	6E+03
103. WO_4	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
104. ZrO	2E+01	8E+00	4E+01	2E+04	1E+04	2E+01	4E+03	4E+02	5E+00	4E+03	2E+01	5E+00
105. Volume	4E+02	4E+02	1E+03	7E+02	6E+02	6E+02	3E+02	3E+02	5E+02	5E+02	6E+02	3E+02

Table 4-16. Summary of Tank Farm Vadose Zone Borehole Geophysical Logging Data.

Tank	Number of Associated Boreholes	Geophysical Evidence of Leaking?	Comments
241-B Tank Farm			
241-B-101	7	Yes	Radioactive increase noted at 12 to 15 m (40 to 50 ft) level in two boreholes, 20-01-01 and 20-01-07, installed during June 174. Borehole 20-01-06 indicated considerable soil contamination from an old leak or spill, since the radiation starts at the top of the tank liner. Borehole readings have remained stable.
241-B-102	6	No	Radiation levels in the vadose zone boreholes have remained stable.
241-B-103	5	Yes	Unexplained activity at the base of Boreholes 20-03-03 and 20-03-06 in 1978. Boreholes have been stable.
241-B-104	2	No	Radiation levels in the vadose zone boreholes have remained stable.
241-B-105	1	Yes	High level of activity in Boreholes 20-05-06 and 20-06-06; radiation levels have remained stable.
241-B-106	4	No	Radiation levels in the vadose zone boreholes have remained stable.
241-B-107	4	No	Dry wells have remained stable.
241-B-108	5	No	Radiation levels in the vadose zone boreholes have remained stable.
241-B-109	3	No	Radiation levels in the vadose zone boreholes have remained stable.

Table 4-16. Summary of Tank Farm Vadose Zone Borehole Geophysical Logging Data.

Tank	Number of Associated Boreholes	Geophysical Evidence of Leaking?	Comments
241-B-110	9	No	Because of substantial contamination, Borehole 20-10-12 has limited use as a leak detector. Borehole radiation levels have remained stable.
241-B-111	1	Yes	Activity in Boreholes 20-11-09 and 20-12-06. Have remained stable during the review period.
241-B-112	5	Yes	Unexplained activity in two boreholes, 20-12-03 and 20-12-06. Boreholes and liquid levels have remained stable during the review period.
241-B-201	0	Yes	Categorized "Questionable Integrity" in 1971 because of increasing activity in Borehole 20-00-01.
241-B-202	0	No	Categorized "Not Intended for Reuse" in April 1976.
241-B-203	0	No	Categorized "Confirmed Leaker" in 1983 and was categorized "Not Intended for Reuse" in April 1976.
241-B-204	0	No	Categorized "Inactive, Sound" and "Not Intended for Reuse" in April 1976.
241-BX Tank Farm			
241-BX-101	3	Yes	Increases in readings from Borehole 21-01-02 in 1972 resulted in the immediate removal of supernatant. Borehole activity has remained steady.
241-BX-102	10	Yes	"Confirmed Leaker" in 1971 as a result of activity detected in Borehole 21-27-11.

Table 4-16. Summary of Tank Farm Vadose Zone Borehole Geophysical Logging Data.

Tank	Number of Associated Boreholes	Geophysical Evidence of Leaking?	Comments
241-BX-103	5	No	Contaminated soil in the vicinity of Boreholes 21-03-03, 21-03-05, and 21-03-12 is believed to have been caused by tank overflow and spillage a number of years ago; 100,000 to 300,000 L (30,000 to 90,000 gal) of waste were spilled on the ground between tanks 241-BX-102 and 241-BX-103 in 1951.
241-BX-104	6	No	None
241-BX-105	6	No	None
241-BX-106	5	No	None
241-BX-107	2	No	Test drilling and augering done in 1974 indicated that the high level of activity in Borehole 21-07-06 was associated with a transfer line leak.
241-BX-108	7	Yes	Activity in Borehole 20-08-06 began to increase in March 1974 (estimated liquid loss was 9,500 L (2,500 gal) with 500 Ci of Cs-137); residual supernatant was removed. All borehole activity has since stabilized.
241-BX-109	4	No	None
241-BX-110	9	Yes	Radiation levels in vadose zone have remained stable.
241-BX-111	6	No	Radiation levels in vadose zone have remained stable.
241-BX-112	6	No	Radiation levels in vadose zone have remained stable.
241-BY Tank Farm			
241-BY-101	5	No	Radiation levels in vadose zone have remained stable.
241-BY-102	5	No	None

Table 4-16. Summary of Tank Farm Vadose Zone Borehole Geophysical Logging Data.

Tank	Number of Associated Boreholes	Geophysical Evidence of Leaking?	Comments
241-BY-103	10	Yes	Increased activity in Borehole 22-03-09 was the basis for removing this unit from service in May 1973. The radiation peak, although of low activity, increased and spread from a range of 18 to 19 m (59 to 62 ft) to a range of 17 to 23 m (56 to 77 ft) by mid-March 1973. Continued monitoring has indicated no further significant increases.
241-BY-104	5	No	None
241-BY-105	3	No	Categorized "Questionable Integrity." Borehole activity has remained stable.
241-BY-106	6	Yes	Borehole 22-06-05 showed radionuclides slowly migrating to a lower depth, from 9.4 m (31 ft) in 1972 to 19.2 m (63 ft) in 1983; but now appears stable. Categorized "Questionable Integrity" in 1977.
241-BY-107	6	No	Nearby activity in Borehole 22-07-02 in 1979 was attributed to non-tank sources; migration due to snow melt.
241-BY-108	7	No	Boreholes have remained stable.
241-BY-109	6	No	None
241-BY-110	4	No	None
241-BY-111	5	No	None
241-BY-112	7	No	None

Table 4-17. Cesium Inventories for Tank Leak Unplanned Releases.

Release Number	Tank	Amount Leaked	^{137}Cs (kCi)
UPR-200-E-127	B-107	8,000 gal	2.00
UPR-200-E-128	B-110	8,300 gal	4.30
UPR-200-E-129	B-201	1,200 gal	0.42
UPR-200-E-130	B-203	300 gal	--
UPR-200-E-131	BX-102	70,000 gal	51.00
UPR-200-E-132	BX-102	2,500 gal	--
UPR-200-E-133	BX-108	2,500 gal	0.50
UPR-200-E-134	BY-103	5,000 gal	--
UPR-200-E-135	BY-108	5,000 gal	--

A dashed line (--) indicates where no data are available.

Table 4-18. Radionuclide Inventories for Burial Sites.

Site ID	Waste Type	^{137}Cs (Ci)	^{106}Ru (Ci)	^{90}Sr (Ci)	Comments
218-E-2	solid, mixed MFP/TRU	213	2.4×10^{-9}	188	--
218-E-2A	solid, mixed waste	--	--	--	no contamination detected
218-E-3	solid, mixed waste	--	--	--	released from radiation zone status
218-E-4	solid, mixed waste	9.4×10^{-2}	1.5×10^{-11}	8.3×10^{-2}	construction waste from 221-B Building
218-E-5	solid, mixed waste	70.7	9.9×10^{-9}	62.7	north end contains railroad boxcars contaminated with UNH
218-E-5A	solid, mixed TRU	165	1.4×10^{-7}	147	contains L Cell, D-2 Column from PUREX
218-E-6	non-hazardous, non-radioactive	--	--	--	released from radiation zone status
218-E-7	solid, mixed MFP/TRU	4.96	2.5×10^{-11}	4.36	heavy vegetation over site
218-E-9	solid, mixed waste	--	--	--	fission product equipment contaminated by 221-U Building uranium recovery program
218-E-10	solid, mixed waste	9.31×10^{5}	7.71×10^{-1}	7.68×10^{-5}	active
200-A Construction Pit	non-hazardous, non-radioactive	--	--	--	--
200-E Powerhouse Ash Pit	non-hazardous, non-radioactive	--	--	--	--

A dashed line (--) indicates where no data are available.

Table 4-19. Summary of Sediment Monitoring for the 216-B-5 Reverse Well.

Well	Date	Depth (m)	Sr-90	Cs-137	Pu-238	Pu-239, 240	Am-241
Sediment Samples (nCi/g)							
Derived Concentration Guidelines (nCi/g)			600,000	20,000,000	75,000	75,000	--
E299-328-7[a/]	1980	88.4	--	7.91E-04	--	--	--
E299-E28-7[a/]	1980	93	3.59E-02	7.57E-05	--	5.33E-02	<3.6E-04
E299-E28-7[a/]	1980	97.5	2.03E-03	6.51E-02	--	4.42E-03	<4.6E-04
E299-E28-23[a/]	1980	88.1	2.19E+01	3.08E+01	--	7.50E+01	2.19E+00
E299-E28-23[a/]	1980	92.1	--	1.65E+01	--	--	--
E299-E28-23[a/]	1980	97.5	--	1.57E+00	--	--	--
E299-E28-24[a/]	1980	88.1	3.17E-01	--	--	6.82E-03	<6.4E-04
E299-E28-24[a/]	1980	91.4	4.54E-02	4.08E-01	--	2.42E-01	3.94E-03
E299-E28-24[a/]	1980	96.8	3.71E-02	6.26E-02	--	4.04E-02	<6.7E-04
E299-E28-25[a/]	1980	88.1	--	1.49E-04	--	--	--
E299-E28-25[a/]	1980	91.4	8.01E-02	2.56E-03	--	2.15E-02	<4.2E-04
E299-E28-25[a/]	1980	97.8	<1.6E-03	4.92E-04	--	2.65E-03	<4.0E-04

[a/] Source: Smith 1980.

A dashed line (--) indicates where no data are available.

Table 4-20. Summary of Sanitary Wastewater and Sewage Received Daily by B Plant Aggregate Area Septic Tanks.

Septic Tank	Waste Volume Received (m3)
2607-EB	0.02
2607-EH	1.36
2607-EK	39.2
2607-EM	6.14
2607-EN	2.06
2607-EO	2.12
2607-EP	0.8
2607-EQ	13.5
2607-ER	NA
2607-E1	11.7
2607-E2	2.38
2607-E3	14.4
2607-E4	0.24
2607-E7B	NA
2607-E8	6.24
2607-E9	0.02
2607-E11	3.16
2607-GF	NA

Source: WHC, 1991a
NA = No data available.

Table 4-21. Summary of Sediment Sampling for the 216-B-3 Pond System

Analyte	Threshold Value[1]	CDL	216-B-3-3 Ditch	216-B-3 Pond	216-B-3A Pond	216-B-3B Pond	216-B-3C Pond
Inorganics	(μg/g)	(μg/L)	(μg/g)	(μg/g)	(μg/g)	(μg/g)	(μg/g)
Aluminum	11,238	--	11,747	13,036	--	--	--
Ammonium	6.26	--	--	10.54	7.69	--	--
Arsenic	4.91	500	<CDL	<CDL	<CDL	<CDL	<CDL
Barium	--	1,000	<CDL	<CDL	<CDL	<CDL	<CDL
Boron	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Bromide	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Cadmium	8.23	--	9.4	11.64	8.7	--	--
Calcium	4,755	--	7,320	4,906	11,146	8,275	5,312
Chloride	1.47	--	--	3.1	2.29	--	7.9
Chromium	12.86	500	18.6	21.05	--	--	--
Cobalt	9.7	--	9.9	10.3	--	--	--
Copper	15.96	--	19.5	21.78	19.35	16.1	18.5
Cyanide	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Fluoride	<CDL	1	1.29	<CDL	<CDL	<CDL	<CDL
Iron	29,437	--	37,479	32,925	--	--	--
Lead	15.16	500	<CDL	142.88	<CDL	<CDL	<CDL
Lithium	10.2	--	10.8	12.78	--	--	--
Magnesium	6,408	--	6,635	6,649	6,546	--	--
Manganese	391	--	464	--	641.5	--	--
Mercury	<CDL	0.2 μg/g	0.3	4.23	--	--	--
Molybdenum	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Nickel	12.3	--	19.2	14.6	--	--	--
Nitrite	2.44	--	<CDL	<CDL	<CDL	<CDL	<CDL
Phosphate	4.56	--	<4.56	<4.56	<4.56	<4.56	<4.56
Potassium	1,758	--	--	1,991.25	--	--	--
Selenium	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Silver	1	500	--	2.55	--	--	1.2
Sodium	280.2	--	--	299.33	465	--	283
Strontium	30.1	--	34.8	34.7	34.85	--	--
Sulfate	5.55	--	7.03	49.06	8.12	--	9.31
Sulfide	--	10 μg/g	<CDL	<CDL	25.7	<CDL	10.9
Thallium	--	--	<CDL	<CDL	<CDL	<CDL	<CDL
Titanium	2,552	--	2,560	2,803.67	--	2,599	--
Vanadium	63.80	--	69.40	70.44	--	69.60	--
Zinc	41.30	--	62.86	64.17	47.79	41.40	57.23
Zirconium	23.10	--	25.80	29.29	27.62	27.18	25.80

Table 4-21. Summary of Sediment Sampling for the 216-B-3 Pond System

Analyte	Threshold Value[1/]	CDL	216-B-3-3 Ditch	216-B-3 Pond	216-B-3A Pond	216-B-3B Pond	216-B-3C Pond
Volatile Organics	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)
Acetone	218	–	–	333	–	–	–
Carbon Disulfide	<CDL	10	–	34	–	–	–
1,3 Dichlorobenzene	26	–	–	–	–	–	–
Methylene Chloride	<CDL	5	14	35	–	–	6
Methyl Ethyl Ketone	<CDL	10	11	35	–	–	12
Semivolatiles	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)
Bis(2-ethylhexyl) phthalate	–	–	ND	ND	ND	ND	ND
Other Organics	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)	(μg/kg)
Herbicides	–	–	ND	ND	ND	ND	ND
Pesticides	–	–	ND	ND	ND	ND	ND
Polychlorinated Biphenyls	–	–	ND	ND	ND	ND	ND
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	–	–	5.5	9.1	4.2	3.7	9.2
Gross Beta	–	–	68.6	103.3	32.2	18.2	290.1
Ce-144	–	–	1.8	0.38	2.03	ND	0.38
CePr-144	–	0.18	ND	0.68	ND	ND	0.68
Co-57	–	–	0.33	ND	ND	ND	ND
Co-60	–	0.02	ND	ND	ND	ND	ND
Cs-134	–	0.02	0.23	nd	0.08	ND	ND
Cs-137	–	0.02	108.2	72.74	5.6	0.01	6.1
K-40	–	0.35	12.2	16	12.6	10.6	11.4
Na-22	–	0.02	0.21	ND	ND	ND	ND
Nb-95	–	–	ND	0.06	0.1	ND	ND
Pb-212	–	–	0.47	0.82	0.7	0.39	0.82
Pb-214	–	–	0.54	0.71	0.47	0.37	0.71
Ru-106	–	0.17	ND	ND	ND	ND	ND
Sr-90	–	0.005	2.1	1.407	0.275	0.04	0.336
Zr-95	–	–	ND	0.04	ND	ND	ND
ZrNb-95	–	0.03	0.47	ND	ND	ND	0.31

Source: WHC 1991c.
All values are averages for regular samples exceeding background tolerance limits.
ND = Non-detectable.
CDL = Contract Detection Limit.
A dashed line (–) indicates where not data are available.
1/ Threshold values are the calculated upper tolerance limits statistically derived from average background values.

Table 4-22. Candidate Contaminants of Potential Concern for the B Plant Aggregate Area.

RADIONUCLIDES

TRANSURANICS

Americium-241
Americium-242
Americium-242m
Americium-243
Curium-242[a/]
Curium-244
Curium-245
Neptunium-237
Neptunium-238[a/]
Neptunium-239[a/]
Plutonium-238
Plutonium-239/240
Plutonium-241
Plutonium-242

URANIUM

Uranium-233
Uranium-234
Uranium-235
Uranium-236
Uranium-238

FISSION PRODUCTS

Actinium-225
Actinium-227
Actinium-228[a/]
Antimony-126[a/]
Antimony-126m[a/]
Astitine-217
Barium-135m[a/]
Barium-137m
Barium-140[a/]
Bismuth-210
Bismuth-211
Bismuth-212[a/]
Bismuth-213
Bismuth-214
Carbon-14
Cerium-141[a/]
Cerium-144[a/]
Cesium-134
Cesium-135
Cesium-137
Cobalt-57[a/]
Cobalt-58[a/]
Cobalt-60
Europium-152
Europium-154
Europium-155
Francium-221
Francium-223[a/]
Gadolinium-152
Iodine-129
Iron-59[a/]
Lanthanum-140[a/]
Lead-209
Lead-210
Lead-211
Lead-212[a/]
Lead-214
Manganese-54[a/]
Nickel-59
Nickel-63
Niobium-93m
Niobium-95[a/]
Niobium-95m[a/]
Palladium-107
Polonium-210
Polonium-211[a/]
Polonium-212[a/]
Polonium-213
Polonium-214
Polonium-215
Polonium-216[a/]
Polonium-218
Potassium-40
Praeseodymium-144[a/]
Praeseodymium-144m[a/]
Promethium-147
Protactinium-231
Protactinium-233[a/]
Protactinium-234[a/]
Protactinium-234m
Radium
Radium-223
Radium-224[a/]
Radium-225
Radium-226
Radium-228
Radon-219
Radon-220[a/]
Radon-222
Rhodium-103[a/]
Rhodium-103m[a/]
Rhodium-106[a/]
Ruthenium-103
Ruthenium-106
Samarium-147
Samarium-151
Selenium-79
Silver-110[a/]
Silver-110m[a/]
Sodium-22
Strontium-85[a/]
Strontium-89[a/]
Strontium-90
Technetium-99
Tellurium-129
Thallium-207
Thallium-208[a/]
Thallium-209
Thorium-227
Thorium-228
Thorium-229
Thorium-230
Thorium-231
Thorium-232
Thorium-233[a/]
Thorium-234
Tin-126[a/]
Tritium
Yttrium-90
Yttrium-91[a/]
Zinc-65[a/]
Zirconium-93
Zirconium-95[a/]

INORGANIC CHEMICALS

Acetic acid
Alkaline liquids
Aluminum
Aluminum nitrate (mono basic)
Aluminum nitrate nonahydrate
Ammonia (anhydrous)
Ammonium carbonate
Ammonium fluoride
Ammonium hydroxide
Ammonium ion
Ammonium nitrate
Ammonium oxalate
Ammonium silicofluoride
Ammonium sulfate

Table 4-22. Candidate Contaminants of Potential Concern for the B Plant Aggregate Area. Page 2 of 3

INORGANIC CHEMICALS (Cont.)

Ammonium oxalate
Ammonium silicofluoride
Ammonium sulfate
Ammonium sulfite
Antifreeze
Arsenic
Barium
Barium nitrate
Beryllium
Bismuth
Bismuth nitrate
Bismuth phosphate
Boric acid
Boron
Cadmium
Cadmium nitrate
Calcium
Calcium carbonate
Calcium chloride
Carbon dioxide
Carbonate
Ceric fluoride
Ceric iodate
Ceric nitrate
Ceric sulfate
Cerium
Cesium carbonate
Cesium chloride
Chloride
Chromium
Chromium nitrate
Chromous sulfate
Copper
Cyanide
DOW Anti-Foam B
Duolite ARC-359 (IX Resin) (sulfonated phenolic)
Ferric cyanide
Ferric nitrate
Ferrous sulfamate
Ferrous sulfate
Fluoride
Hydrobromic acid
Hydrochloric acid
Hydrofluoric acid
Hydrogen
Hydrogen Fuloride
Hydrogen peroxide
Hydroiodic acid
Hydroxide
Hydroxyacetic acid
Hydroxylamine hydorchloride
Hyflo-Super-Cel (contains silica)
Iron
Lanthanum fluoride
Lanthanum hydroxide
Lanthanum nitrate
Lanthanum-neodynium nitrate
Lead
Lead nitrate
Lithium
Magnesium
Magnesium carbonate
Magnesium nitrate
Manganese
Mercuric nitrate
Mercury
Misc. Toxic Process Chemicals
Nickel
Nickel nitrate
Niobium
Nitrate
Nitric acid
Nitrite
Normal paraffin hydrocarbon
Oxalic acid
Periodic acid
Phosphate
Phosphoric acid
Phosphorous pentoxide
Phosphotungetic acid
Plutonium fluoride
Plutonium nitrate
Plutonium peroxide
Potassium
Potassium carbonate
Potassium ferrocyanide
Potassium fluoride
Potassium hydroxide
Potassium oxalate
Potassium permanganate
Pu-Lanthanum fluoride
Pu-Lanthanum oxide
Rubidium
Silica
Silicon
Silver
Silver nitrate
Sodium
Sodium aluminate
Sodium bismuthate
Sodium bisulfate
Sodium bromate
Sodium carbonate
Sodium citrate
Sodium dichromate
Sodium ferrocyanide
Sodium fluoride
Sodium gluconate
Sodium hydroxide
Sodium nitrate
Sodium nitrite
Sodium persulfate
Sodium phosphate
Sodium sulfate
Sodium thiosulfate
Strontium carbonate
Strontium fluoride
Strontium sulfate
Sugar
Sulfamic acid
Sulfate
Sulfuric acid
Tartaric acid
Thorium
Tin
Titanium
Uranium
Uranium oxide
Uranyl nitrate hexahydrate
Various acids
Yttrium
Zeolon
Zinc
Zirconium
Zirconyl nitrate

ORGANIC CHEMICALS

1-Butanol
1-Butanone
2-Butanone
Acetone

Table 4-22. Candidate Contaminants of Potential Concern for the B Plant Aggregate Area. Page 3 of 3

<u>ORGANIC CHEMICALS</u> (Cont.)	Hydroxylamine nitrate	Trisodium hydroxyethyl ethylene-diamine triacetate (HEDTA)
Bismuth phosphate	Ionac A-580/Pemutit SK (IX Resin)	Waste Paint and Thinners
Butanoic acid	Isopropyl alcohol	Zeolite AW-500 (IX Resin)
Butyl alchohol	Kerosene	
Butylated hydroxy toluene	Methyl ethyl ketone	
Carbon tetrachloride	Methylene chloride	
Cesium phosphtungetic salts	Misc. toxic process chemicals	
Chloroform	Molybdate-citrate reagent	
Chloroplatinic acid	Monobutyl phosphate	
Citric acid	Normal parrafin hydrocarbon	
Decane	Paraffin hydrocarbons	
Di2-ethyl hexyl phosphoric acid	PCBs	
Dibutyl butyl phosphonate	Propanol	
Dibutyl phosphate	Shell E-2342 (Napthalene and paraffin)	
Dichloromethane	Sodium acetate	
Diesel fuel	Soltrol-170 ($ClOH_{22}$ to Cl_6H_{34}; purified kerosene)	
Dowex 21 K/Amberlite XE-270 (IX Resin)	Tartaric acid	
Ethanol	Tetrasodium ethylene diamine tetra-acetate (EDTA)	
Ethyl ether	Thenoyltrifluoroacetone	
Flammable solvents	Toluene	
Formaldehyde (solution)	Tri-n-dodecylamine	
Grease	Tributyl phosphate	
Halogenated hydrocarbons	Trichloroethane	
Hydrazine	Trichloromethane	
Hydroxy acetic acid-Trisodium hydroxy ethylene-Diamine triacetic acid		

a/ The radionuclide has a half-life of <1 year and if it is a daughter product, the parent has a half-life of <1 year, or the buildup of the short-lived daughter would result in an activity of <1% of the parent radionuclide's initial activity.

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
			Plants, Buildings, and Storage Areas				
2703-E Hazardous Waste Staging Area	--	--	--	S	K	S	S
2704-E Hazardous Waste Staging Area	--	--	--	S	K	K	K
2715-EA Hazardous Waste Staging Area	--	--	--	S	S	K	K
226-B Hazardous Waste Staging Facility	--	--	--	S	K	K	K
224-B Concentration Facility	K	K	S	K	S	S	K
			Tanks and Vaults				
241-B-101 Single-Shell Tank	K	K	K	K	K	K	K
241-B-102 Single-Shell Tank	K	K	K	K	K	K	K
241-B-103 Single-Shell Tank	K	K	K	K	K	K	K
241-B-104 Single-Shell Tank	K	K	K	K	K	K	K
241-B-105 Single-Shell Tank	K	K	K	K	K	K	K
241-B-106 Single-Shell Tank	K	K	K	K	K	K	K
241-B-107 Single-Shell Tank	K	K	K	K	K	K	K
241-B-108 Single-Shell Tank	K	K	K	K	K	K	K
241-B-109 Single-Shell Tank	K	K	K	K	K	K	K
241-B-110 Single-Shell Tank	K	K	K	K	K	K	K
241-B-111 Single-Shell Tank	K	K	K	K	K	K	K
241-B-112 Single-Shell Tank	K	K	K	K	K	K	K
241-B-201 Single-Shell Tank	K	K	K	K	K	K	K

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
241-B-202 Single-Shell Tank	K	K	K	K	K	K	K
241-B-203 Single-Shell Tank	K	K	K	K	K	K	K
241-B-204 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-101 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-102 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-103 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-104 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-105 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-106 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-107 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-108 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-109 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-110 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-111 Single-Shell Tank	K	K	K	K	K	K	K
241-BX-112 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-101 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-102 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-103 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-104 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-105 Single-Shell Tank	K	K	K	K	K	K	K

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
241-BY-106 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-107 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-108 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-109 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-110 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-111 Single-Shell Tank	K	K	K	K	K	K	K
241-BY-112 Single-Shell Tank	K	K	K	K	K	K	K
241-B-301B Catch Tank	S	S	S	S	S	S	S
241-B-302B Catch Tank	S	S	S	S	S	S	S
241-BX-302A Catch Tank	S	S	S	S	S	S	S
241-BX-302B Catch Tank	S	S	S	S	S	S	S
241-BX-302C Catch Tank	S	S	S	S	S	S	S
241-ER-311 Catch Tank	S	S	S	S	S	S	S
241-B-361 Settling Tank	K	K	S	S	S	S	S
270-E Condensate Neutralization Tank	--	K	--	--	--	--	--
244-BXR Receiving Vault	K	K	K	K	K	K	K
Cribs and Drains							
216-B-7A Crib	K	K	K	S	K	S	S
216-B-7B Crib	K	K	K	S	K	S	S
216-B-10A Crib	K	K	K	S	K	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
216-B-10B Crib	K	K	K	S	S	S	S
216-B-12 Crib	K	K	K	S	K	S	S
216-B-14 Crib	K	K	K	S	K	S	S
216-B-15 Crib	K	K	K	S	K	S	S
216-B-16 Crib	K	K	K	S	K	S	S
216-B-17 Crib	K	K	K	S	K	S	S
216-B-18 Crib	K	K	K	S	K	S	S
216-B-19 Crib	K	K	K	S	K	S	S
216-B-43 Crib	K	K	K	S	K	S	S
216-B-44 Crib	K	K	K	S	K	S	S
216-B-45 Crib	K	K	K	S	K	S	S
216-B-46 Crib	K	K	K	S	K	S	S
216-B-47 Crib	K	K	K	S	K	S	S
216-B-48 Crib	K	K	K	S	K	S	S
216-B-49 Crib	K	K	K	S	K	S	S
216-B-50 Crib	K	K	K	S	K	S	S
216-B-55 Crib	K	K	K	S	K	S	S
216-B-56 Crib	--	S	--	--	--	--	--
216-B-57 Crib	K	K	K	S	K	S	S
216-B-60 Crib	K	K	K	S	S	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases. Page 5 of 13

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
216-B-61 Crib	--	--	--	--	--	--	--
216-B-62 Crib	K	K	K	S	S	S	S
216-B-8TF Crib/Tile Field	K	K	K	S	K	S	S
216-B-9TF Crib/Tile Field	K	K	K	S	K	S	S
216-B-13 French Drain	K	K	S	--	S	--	--
216-B-51 French Drain	--	S	--	--	K	--	--
Chemical Tile Field North of 2703-E	--	K	--	--	--	--	--
Reverse Wells							
216-B-4 Reverse Well	K	K	S	S	S	S	S
216-B-5 Reverse Well	K	K	S	S	K	S	S
216-B-6 Reverse Well	K	K	S	S	K	S	S
216-B-11A Reverse Well	K	K	K	S	S	S	S
216-B-11B Reverse Well	K	K	K	S	S	S	S
Ponds, Ditches, and Trenches							
216-B-3 Pond	K	K	K	S	S	S	S
216-B-3A Pond	--	--	--	--	--	--	--
216-B-3B Pond	--	--	--	--	--	--	--
216-B-3C Pond	--	--	--	--	--	--	--
216-A-25 Pond	K	K	K	S	S	S	S
216-E-28 Contingency Pond	--	--	--	--	--	--	--

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
216-N-8 Pond	S	K	S	S	S	S	K
2101-M Pond	--	--	--	--	K	K	K
216-B-2-1 Ditch	K	K	K	S	S	S	S
216-B-2-2 Ditch	K	K	K	S	S	S	S
216-B-2-3 Ditch	S	K	S	S	S	S	S
216-B-3-1 Ditch	S	K	S	S	S	S	S
216-B-3-2 Ditch	S	K	S	S	S	S	S
216-B-3-3 Ditch	--	K	--	S	S	S	S
216-B-20 Trench	K	K	K	S	K	S	S
216-B-21 Trench	K	K	K	S	K	S	S
216-B-22 Trench	K	K	K	S	K	S	S
216-B-23 Trench	K	K	K	S	K	S	S
216-B-24 Trench	K	K	K	S	K	S	S
216-B-25 Trench	K	K	K	S	K	S	S
216-B-26 Trench	K	K	K	S	K	S	S
216-B-27 Trench	K	K	K	S	K	S	S
216-B-28 Trench	K	K	K	S	K	S	S
216-B-29 Trench	K	K	K	S	K	S	S
216-B-30 Trench	K	K	K	S	K	S	S
216-B-31 Trench	K	K	K	S	K	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
216-B-32 Trench	K	K	K	S	K	S	S
216-B-33 Trench	K	K	K	S	K	S	S
216-B-34 Trench	K	K	K	S	K	S	S
216-B-35 Trench	K	K	K	S	K	S	S
216-B-36 Trench	K	K	K	S	K	S	S
216-B-37 Trench	K	K	K	S	K	S	S
216-B-38 Trench	K	K	K	S	K	S	S
216-B-39 Trench	K	K	K	S	K	S	S
216-B-40 Trench	K	K	K	S	K	S	S
216-B-41 Trench	K	K	K	S	K	S	S
216-B-42 Trench	K	K	K	S	K	S	S
216-B-52 Trench	K	K	K	S	K	S	S
216-B-53A Trench	K	K	K	--	--	--	--
216-B-53B Trench	K	K	K	--	--	--	--
216-B-54 Trench	K	K	K	--	--	--	--
216-B-58 Trench	K	K	K	--	--	--	--
216-B-63 Trench	K	K	K	S	S	S	S
Septic Tanks and Associated Drain Fields							
2607-E1 Septic Tank	--	--	--	S	S	S	--
2607-E2 Septic Tank	--	--	--	S	S	S	--

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
2607-E3 Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-E4 Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-E7B Septic Tank	--	--	--	S	S	S	--
2607-E8 Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-E9 Septic Tank	--	--	--	S	S	S	--
2607-E11 Septic Tank	--	--	--	S	S	S	--
2607-EB Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-EH Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-EK Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-EM Septic Tank	--	--	--	S	S	S	--
2607-EN Septic Tank	--	--	--	S	S	S	--
2607-EO Septic Tank	--	--	--	S	S	S	--
2607-EP Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-EQ Septic Tank/Drain Field	--	--	--	S	S	S	--
2607-ER Septic Tank	--	--	--	S	S	S	--
2607-GF Septic Tank/Drain Field	--	--	--	S	S	S	--
Transfer Facilities, Diversion Boxes, and Pipelines							
241-B-151 Diversion Box	S	S	S	S	S	S	S
241-B-152 Diversion Box	S	S	S	S	S	S	S
241-B-153 Diversion Box	S	S	S	S	S	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
241-B-154 Diversion Box	S	S	S	S	S	S	S
241-B-252 Diversion Box	S	S	S	S	S	S	S
241-BR-152 Diversion Box	S	S	S	S	S	S	S
241-BX-153 Diversion Box	S	S	S	S	S	S	S
241-BX-154 Diversion Box	S	S	S	S	S	S	S
241-BX-155 Diversion Box	S	S	S	S	S	S	S
241-BXR-151 Diversion Box	S	S	S	S	S	S	S
241-BXR-152 Diversion Box	S	S	S	S	S	S	S
241-BXR-153 Diversion Box	S	S	S	S	S	S	S
241-BYR-152 Diversion Box	S	S	S	S	S	S	S
241-BYR-153 Diversion Box	S	S	S	S	S	S	S
241-BYR-154 Diversion Box	S	S	S	S	S	S	S
241-ER-151 Diversion Box	S	S	S	S	S	S	S
241-ER-152 Diversion Box	S	S	S	S	S	S	S
242-B-151 Diversion Box	S	S	S	S	S	S	S
Basins							
207-B Retention Basin	S	K	S	S	S	S	S
216-B-59B Retention Basin	--	S	--	--	--	--	--
216-B-64 Retention Basin	S	K	S	S	S	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
Burial Sites							
218-E-2 Burial Ground	K	K	K	--	--	--	--
216-E-2A Burial Ground	--	--	--	--	--	--	--
218-E-3 Burial Ground	--	--	--	--	--	--	--
218-E-4 Burial Ground	K	K	K	--	--	--	--
218-E-5 Burial Ground	K	K	K	--	--	--	--
218-E-5A Burial Ground	K	K	K	--	--	--	--
216-E-6 Burial Ground	--	S	--	--	S	--	--
218-E-7 Burial Ground	K	K	S	--	--	--	--
218-E-9 Burial Ground	--	K	K	--	--	--	--
218-E-10 Burial Ground	K	K	K	S	S	S	S
200 Area Construction Pit	--	--	--	--	--	--	--
200-E Powerhouse Ash Pit	--	--	--	--	--	--	--
Unplanned Releases							
UN-200-E-1	S	K	S	S	S	S	S
UN-200-E-2	--	S	--	--	--	--	--
UN-200-E-3	S	K	S	--	--	--	--
UN-200-E-7	S	K	S	S	S	S	S
UN-200-E-9	S	S	S	S	S	S	K
UN-200-E-14	--	--	--	--	--	--	--

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
UN-200-E-41	S	K	S	S	S	--	S
UN-200-E-43	--	K	--	--	--	--	--
UN-200-E-44	S	K	S	S	S	--	S
UN-200-E-45	S	S	S	S	S	S	S
UN-200-E-52	--	K	--	--	--	--	--
UN-200-E-54	--	K	--	--	--	--	--
UN-200-E-55	--	K	--	--	--	--	--
UN-200-E-61	--	K	--	--	--	--	--
UN-200-E-63	--	K	--	--	--	--	--
UN-200-E-64	--	K	--	--	--	--	--
UN-200-E-69	--	K	--	--	--	--	--
UN-200-E-76	--	K	--	S	--	--	--
UN-200-E-79	--	K	--	--	--	--	--
UN-200-E-80	--	K	--	K	--	--	--
UN-200-E-83	--	K	--	--	--	--	--
UN-200-E-85	--	K	--	--	K	--	--
UN-200-E-87	K	K	S	--	--	--	--
UN-200-E-89	S	K	S	S	--	--	--
UN-200-E-90	--	S	--	--	--	--	--
UN-200-E-92	--	K	--	--	--	--	--

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
UN-200-E-95	--	K	--	--	--	--	--
UN-200-E-101	--	K	--	--	--	--	--
UN-200-E-103	S	K	S	S	S	--	S
UN-200-E-105	S	K	S	S	S	--	S
UN-200-E-109	--	--	--	--	--	--	--
UN-200-E-110	--	--	--	--	--	--	--
UN-200-E-112	--	K	--	--	--	--	--
UN-200-E-140	--	--	--	--	--	K	--
UPR-200-E-4	--	K	--	--	--	--	--
UPR-200-E-5	--	--	--	--	--	--	--
UPR-200-E-6	--	K	--	--	--	--	--
UPR-200-E-32	--	K	--	--	S	S	S
UPR-200-E-34	K	K	S	--	--	--	--
UPR-200-E-38	S	K	S	S	S	S	S
UPR-200-E-51	--	--	--	K	--	--	--
UPR-200-E-73	S	K	S	S	S	S	S
UPR-200-E-74	S	K	S	S	S	S	S
UPR-200-E-75	S	K	S	S	S	S	S
UPR-200-E-77	S	S	S	K	S	S	S
UPR-200-E-78	S	K	S	S	S	S	S

Table 4-23. Summary of Known and Suspected Contamination at B Plant Aggregate Area Waste Management Units and Unplanned Releases.

Waste Management Unit	TRU	Fission Products	Uranium	Heavy Metals	Other Inorganics	Volatiles	Semi-volatiles
UPR-200-E-84	--	K	--	--	--	--	--
UPR-200-E-108	S	K	S	K	--	--	--
UPR-200-E-116	--	K	--	--	--	--	--
UPR-200-E-127	S	K	S	--	--	--	--
UPR-200-E-128	S	K	S	--	--	--	--
UPR-200-E-129	S	K	S	--	--	--	--
UPR-200-E-130	--	S	--	K	K	--	--
UPR-200-E-131	S	K	S	--	--	--	--
UPR-200-E-132	S	K	S	--	--	--	--
UPR-200-E-133	S	K	S	--	--	--	--
UPR-200-E-134	S	K	S	--	--	--	--
UPR-200-E-135	--	S	--	--	--	--	K
UPR-200-E-138	--	K	--	--	--	--	--

K = Known contamination (based on specific media sampling data and liquid disposal inventories).

S = Suspected contamination (specific sampling media data of liquid disposal inventory data lacking, but historical process information indicates that contamination of media could occur).

A dashed line (--) indicates where no data are available.

Table 4-24. Contaminants of Potential Concern for the B Plant Aggregate Area.

RADIONUCLIDES

Gross alpha
Gross beta

TRANSURANICS

Americium-241
Americium-242
Americium-242m
Americium-243
Curium-244
Curium-245
Neptunium-237
Plutonium-238
Plutonium-239/240
Plutonium-241
Plutonium-242

URANIUM

Uranium-233
Uranium-234
Uranium-235
Uranium-236
Uranium-238

FISSION PRODUCTS

Actinium-225
Actinium-227
Astitine-217
Barium-137m
Bismuth-210
Bismuth-211
Bismuth-213
Bismuth-214
Carbon-14
Cesium-134
Cesium-135
Cesium-137
Cobalt-60
Europium-152
Europium-154
Europium-155
Francium-221
Gadolinium-152
Iodine-129
Lead-209
Lead-210

FISSION PRODUCTS (continued)

Lead-211
Lead-214
Nickel-59
Nickel-63
Niobium-93m
Palladium-107
Polonium-210
Polonium-213
Polonium-214
Polonium-215
Polonium-218
Potassium-40
Promethium-143
Protactinium-231
Protactinium-234m
Radium-223
Radium-225
Radium-226
Radium-228
Radon-219
Radon-222
Ruthenium-106
Samarium-147
Samarium-151
Selenium-79
Sodium-22
Strontium-90
Technetium-99
Thallium-207
Thorium-227
Thorium-229
Thorium-230
Thorium-231
Thorium-232
Thorium-234
Tritium
Yttrium-90
Zirconium-93

HEAVY METALS

Arsenic
Barium
Beryllium
Cadmium
Chromium
Copper

HEAVY METALS

Iron
Lead
Manganese
Mercury
Nickel
Silver
Tin
Uranium
Zinc

OTHER INORGANICS

Ammonia
Boron
Cyanide
Fluoride
Nitrate/Nitrite
Sulfuric Acid

VOLATILE ORGANICS

1-Butanol
Acetone
Carbon tetrachloride
Chloroform
Ethyl ether
Methylene chloride
Methyl ethyl ketone
Toluene
1,1,1-Trichloroethane

SEMIVOLATILE ORGANICS

Hydrazine
Kerosene
PCBs
Tributyl phosphate

Table 4-25. Soil-Water Distribution Coefficient K_d for Radionuclides[a/] and Inorganics of Concern at B Plant Aggregate Area Waste Management Units. Page 1 of 3

Element or Chemical	Recommended K_d for Hanford Site (Serne and Wood 1990) in mL/g	Conservative Default K_d[b/] (Serne and Wood 1990) in mL/g	MEPAS Default K_d pH 6-9[c/] (Strenge and Peterson 1989) in mL/g	Mobility Class
Actinium	--	--	228	low
Americium	100 - 1000 (<1 @ pH 1-3)	100	82	low
Ammonia	--	--	--	unknown
Astitine	--	--	--	unknown
Arsenic	--	0	5.86	moderate
Barium	--	50	530	moderate
Beryllium	--	--	1,400	low
Bismuth	--	20	--	moderate
Boron	--	--	0.19	high
Cadmium	--	15	14.9	moderate
Carbon (^{14}C)	--	0 m<5	0	high
Cesium	200 - 1,000 1 - 200 (acidic waste)	50	51	low
Chromium	--	0	16.8	moderate
Cobalt	500 - 2000	10	1.9	low
Copper	--	15	41.9	moderate
Curium	100 - >2,000	100	82	low
Cyanide	--	0	--	high
Europium	--	--	228	low
Fluoride	--	0 m <1	0	high
Francium	--	--	--	unknown
Gadolinium	--	--	--	unknown
Iodine	<1	0	0	high
Iron	--	20	15	moderate
Lead	--	30	234	moderate
Manganese	--	20	16.5	moderate
Mercury	--	--	322	low

Table 4-25. Soil-Water Distribution Coefficient K_d for Radionuclides[a] and Inorganics of Concern at B Plant Aggregate Area Waste Management Units. Page 2 of 3

Element or Chemical	Recommended K_d for Hanford Site (Serne and Wood 1990) in mL/g	Conservative Default K_d[b] (Serne and Wood 1990) in mL/g	MEPAS Default K_d pH 6-9[c] (Strenge and Peterson 1989) in mL/g	Mobility Class
Neptunium	<1-5	3	3	high
Nickel	--	15	12.2	moderate
Niobium	--	--	50	moderate
Nitrate/Nitrite	--	0 m <1	0	high
Palladium	--	--	4	high
Plutonium	100 - 1,000 < 1 at pH 1 - 3	100	10	low
Polonium	--	--	5.9	moderate
Potassium	--	--	0.2	high
Protactinium	--	--	0	high
Promethium	--	--	--	unknown
Radium	--	20	24.3	moderate
Radon	--	--	--	unknown
Ruthenium	20 - 700 (<2 at >1 M nitrate)	--	274	moderate
Samarium	--	--	228	low
Selenium	--	0	5.91	high
Silver	--	20	0.4	moderate
Sodium	--	3	0	high
Strontium	5 - 100 3 - 5 (acidic conditions) 200 - 500 (w/phosphate or oxalate)	10	24.3	moderate
Sulfuric Acid	--	--	0	high
Technetium	0 - 1	0	3	high
Thallium	--	--	0	high
Thorium	--	50	100	moderate
Tin	--	--	10	moderate
Titanium	--	--	--	unknown
Tritium	0	0	0	high

Table 4-25. Soil-Water Distribution Coefficient K_d for Radionuclides[a] and Inorganics of Concern at B Plant Aggregate Area Waste Management Units. Page 3 of 3

Element or Chemical	Recommended K_d for Hanford Site (Serne and Wood 1990) in mL/g	Conservative Default K_d[b] (Serne and Wood 1990) in mL/g	MEPAS Default K_d pH 6-9[c] (Strenge and Peterson 1989) in mL/g	Mobility Class
Uranium	--	0	0	high
Yttrium	--	--	228	low
Zinc	--	15	12.7	moderate
Zirconium	--	30	50	moderate

a/ Radionuclides with half-lives of greater than 3 months.
b/ Average K_Ds for low salt and organic solutions with neutral pH.
c/ Default values for pH 6 to 9 and soil content of [clay + organic matter + metal oxyhydroxides] < 10% (Strenge and Peterson 1989).
A dashed line (--) indicates where no data are available.

Table 4-26. Mobility of Inorganic Species in Soil.

Highly mobile ($K_d < 5$)	
Boron	Protactinium
Carbon (as $^{14}CO_2$)	Selenium
Cyanide	Sodium
Fluoride	Sulfuric acid
Iodine	Technetium
Neptunium	Thallium
Nitrate/Nitrite	Tritium
Falladium	Uranium
Palladium	
Potassium	
Moderately mobile ($5 < K_d < 100$)	
Arsenic	Nickel
Barium	Niobium
Bismuth	Polonium
Cadmium	Radium
Chromium	Ruthenium
Copper	Silver
Iron	Strontium
Lead	Thorium
Manganese	Tin
	Zinc
	Zirconium
Low mobility ($K_d > 100$)	
Actinium	
Americium	
Beryllium	
Cesium	
Cobalt	
Curium	
Europium	
Mercury	
Plutonium	
Samarium	
Yttirum	

Table 4-27. Physical/Chemical Properties of Organic Contaminants of Concern for B Plant Aggregate Area Waste Management Units.

Compound	Molecular Weight in g/mole	Water Solubility in mg/L	Vapor Pressure in mm Hg	Henry's Law Constant in atm-m^3/mo	Soil/Organic Matter Partition Coef. K_{oc} in mL/g
Acetone	58.0	miscible	270	2.1 x 10^{-5}	2.2
1-Butanol	74.1	79,000	24	4.8 X 10^{-6}	4.7
Carbon tetrachloride	154.0	758	90	2.4 x 10^{-2}	110
Chloroform (trichloromethane)	119	8,200	150	2.9 x 10^{-3}	31
Ehtyl ether	74.1	65,000	440	9.0 X 10^{-4}	4.8
Hydrazine	32.1	300,000	14	2.0 X 10^{-6}	0.005
Kerosene[a/]	142.2	32	0.045	2.9 x 10^{-4}	4,500
Methylene chloride	84.9	20,000	360	2 x 10^{-3}	8.8
Methy ethyl ketone	72.1	270,000	78	2.7 X 10^{-5}	4.5
PCBs	328.0	0.031	7.7 X 10^{-5}	1.1 X 10^{-3}	5.3 X 10^{5}
Toluene	92.2	540	28	6.4 X 10^{-3}	30
Tributyl phosphate	266.3	280	15	1.9 x 10^{-2}	6,000
1,1,1 Trichloroethane	133.41	1.5E+3	1.2E+2	1.4E-2	1.5E+2

Source: Strenge and Peterson (1989).

[a/] Kerosene properties are represented by 2-methyl naphthalene.

Table 4-28. Radiological Properties of Potential Radionuclides of Concern in B Plant Aggregate Area Waste Management Units.

Radionuclide	Half-Life	Specific Activity[a/] in Ci/g	Principal Radiation of Concern[b/]
^{225}Ac	10 d	5.8×10^{4}	α
^{227}Ac	21.8 yr	7.2×10^{1}	β, α
^{241}Am	432 yr	3.4×10^{0}	α
^{242}Am	16 hr	8.1×10^{5}	β
^{242m}Am	152 yr	9.7×10^{0}	α
^{243}Am	7,380 yr	2.0×10^{-1}	α
^{217}At	0.03 sec	$1.7 \text{ X } 10^{12}$	α
^{137m}Ba	2.6 min	5.3×10^{8}	γ
^{210}Bi	5.01 d	1.2×10^{5}	β
^{211}Bi	2.13 min	4.2×10^{8}	α, β
^{213}Bi	45.6 min	1.9×10^{7}	β, α
^{214}Bi	19.9 min	4.4×10^{7}	β, γ
^{14}C	5,730 yr	4.5×10^{0}	β
^{244}Cm	18.1 yr	8.1×10^{1}	α
^{245}Cm	8,500 yr	1.7×10^{-1}	α, γ
^{60}Co	5.3 yr	1.1×10^{3}	γ
^{134}Cs	2.06 yr	1.3×10^{3}	γ
^{135}Cs	3×10^{6} yr	8.8×10^{-4}	β
^{137}Cs	30 yr	8.7×10^{1}	γ
^{152}Eu	13.3 yr	7.7×10^{2}	β, γ[c/]
^{154}Eu	8.8 yr	2.7×10^{2}	β, γ[c/]
^{155}Eu	4.96 yr	4.6×10^{2}	β, γ
^{221}Fr	4.8 min	1.8×10^{8}	α, γ
^{152}Gd	$1.1 \text{ X } 10^{14}$ yr	$8.1 \text{ X } 10^{-11}$	α
^{3}H	12.3 yr	9.7×10^{3}	β
^{129}I	1.6×10^{7} yr	1.7×10^{-4}	β
^{40}K	1.3×10^{9} yr	6.7×10^{-6}	β, γ[c/]
^{59}Ni	8×10^{4} yr	7.6×10^{-2}	γ
^{63}Ni	92 yr	6.2×10^{2}	β
^{22}Na	2.6 yr	6.3×10^{3}	β, γ
^{93m}Nb	14.6 yr	2.8×10^{2}	γ[c/]
^{237}Np	2.14×10^{6} yr	7.0×10^{-4}	α, γ
^{239}Np	2.35 d	2.3×10^{5}	β
^{231}Pa	32,800 yr	4.7×10^{-2}	α

Table 4-28. Radiological Properties of Potential Radionuclides of Concern in B Plant Aggregate Area Waste Management Units. Page 2 of 3

Radionuclide	Half-Life	Specific Activity[a/] in Ci/g	Principal Radiation of Concern[b/]
^{234m}Pa	1.2 min	6.7×10^{8}	β, γ
^{209}Pb	3.25 hr	4.5×10^{6}	β
^{210}Pb	22.3 yr	7.6×10^{1}	β
^{211}Pb	36.1 min	2.5×10^{7}	β
^{214}Pb	26.8 min	3.3×10^{7}	β, γ[c/]
^{107}Pd	6.5×10^{6} yr	5.1×10^{-4}	β
^{210}Po	138 d	4.5×10^{3}	α,γ
^{213}Po	4.2×10^{-6} sec	1.3×10^{16}	α
^{214}Po	6×10^{-5} sec	8.8×10^{14}	α
^{215}Po	7.8×10^{-4} sec	2.9×10^{13}	α
^{218}Po	3.05 min	2.8×10^{8}	α
^{143}Pr	14 d	6.5×10^{4}	β
^{238}Pu	87.7 yr	1.7×10^{1}	α
^{239}Pu	24,400 yr	6.2×10^{-2}	α
^{240}Pu	6,560 yr	2.3×10^{-1}	α
^{241}Pu	14.4 yr	1.0×10^{2}	β
^{242}Pu	3.8×10^{5}yr	3.9×10^{-3}	α
^{223}Ra	11.4 d	5.1×10^{4}	α
^{225}Ra	14.8 d	3.9×10^{4}	β
^{226}Ra	1,600 yr	9.9×10^{-1}	α
^{228}Ra	5.8 yr	2.7×10^{2}	β
^{219}Rn	4.0 sec	1.2×10^{10}	α
^{222}Rn	3.8 d	1.5×10^{5}	α,γ
^{106}Ru	1.0 yr	3.4×10^{3}	β, γ[c/]
^{79}Se	<65,000 yr	7.0×10^{-2}	β
^{147}Sm	6.9×10^{9} yr	3.5×10^{-7}	α
^{151}Sm	90 yr	2.6×10^{1}	β
^{90}Sr	28.5 yr	1.4×10^{2}	β
^{99}Tc	213,000 yr	1.7×10^{-2}	β
^{227}Th	18.7 d	3.1×10^{4}	α
^{229}Th	7,340 yr	2.1×10^{-1}	α
^{230}Th	77,000 yr	2.1×10^{-2}	α
^{231}Th	25.5 hr	5.3×10^{5}	β
^{232}Th	1.4×10^{10} yr	1.1×10^{-7}	α

Table 4-28. Radiological Properties of Potential Radionuclides of Concern in B Plant Aggregate Area Waste Management Units. Page 3 of 3

Radionuclide	Half-Life	Specific Activity[a/] in Ci/g	Principal Radiation of Concern[b/]
^{234}Th	24.1 d	2.3 X 10^{4}	β
^{207}Tl	4.8 min	1.9 x 10^{8}	β, γ
^{233}U	159,000 yr	9.7 x 10^{-3}	α
^{234}U	244,500 yr	6.2 x 10^{-3}	α
^{235}U	7.0 x10^{8} yr	2.2 x 10^{-6}	α, γ
^{236}U	3.4 X 10^{6} yr	4.5 X 10^{-4}	α
^{238}U	4.5 x10^{9} yr	3.4 x 10^{-7}	α
^{90}Y	6.41 hr	5.4 x 10^{5}	β
^{93}Zr	1.5 x 10^{6} yr	2.6 x 10^{-3}	β

a/ Calculated from half-life and atomic weight.
b/ α - alpha decay; β - negative beta decay; γ - release of gamma rays.
c/ Daughter radiation.

Table 4-29. Comparison of Radionuclide Relative Risks or Radionuclides of Concern at the B Plant Aggregate Area. Page 1 of 3

Radionuclide	Air Unit Risk[a] in $(pCi/m^3)^{-1}$	Drinking Water Unit Risk[b] in $(pCi/L)^{-1}$	Soil Ingestion Unit Risk[c] in $(pCi/g)^{-1}$	External Exposure Unit Risk[d] in $(pCi/g)^{-1}$
^{225}Ac	1.2×10^{-3}	8.7×10^{-7}	4.6×10^{-8}	9.4×10^{-6}
^{227}Ac	4.2×10^{-2}	1.8×10^{-5}	9.5×10^{-7}	1.3×10^{-7}
^{241}Am	2.1×10^{-2}	1.6×10^{-5}	8.4×10^{-7}	1.6×10^{-5}
^{242}Am	NA	NA	NA	NA
^{242m}Am	NA	NA	NA	NA
^{243}Am	2.1×10^{-2}	1.5×10^{-5}	8.1×10^{-7}	3.6×10^{-5}
^{217}At	2.9×10^{-11}	2.3×10^{-13}	1.2×10^{-14}	1.4×10^{-7}
^{137m}Ba	3.0×10^{-10}	1.2×10^{-10}	6.5×10^{-12}	3.4×10^{-4}
^{210}Bi	4.1×10^{-5}	9.7×10^{-8}	5.1×10^{-9}	0
^{211}Bi	9.7×10^{-8}	6.1×10^{-10}	3.2×10^{-11}	2.8×10^{-5}
^{213}Bi	1.6×10^{-7}	1.2×10^{-8}	6.2×10^{-10}	8.1×10^{-5}
^{214}Bi	1.1×10^{-6}	7.2×10^{-9}	3.8×10^{-10}	8.0×10^{-4}
^{14}C	3.2×10^{-9}	4.7×10^{-8}	2.5×10^{-9}	0
^{244}Cm	1.4×10^{-2}	1.0×10^{-5}	5.4×10^{-7}	5.9×10^{-7}
^{245}Cm	NA	NA	NA	NA
^{60}Co	8.1×10^{-5}	7.8×10^{-7}	4.1×10^{-8}	1.3×10^{-3}
^{134}Cs	1.4×10^{-5}	2.1×10^{-6}	1.1×10^{-7}	8.9×10^{-4}
^{135}Cs	1.4×10^{-6}	2.1×10^{-7}	1.1×10^{-8}	0
^{137}Cs	9.6×10^{-6}	1.4×10^{-6}	7.6×10^{-8}	0
^{152}Eu	6.1×10^{-3}	1.1×10^{-7}	5.7×10^{-9}	6.3×10^{-4}
^{154}Eu	7.2×10^{-5}	1.5×10^{-7}	8.1×10^{-9}	6.8×10^{-4}
^{155}Eu	NA	NA	NA	–
^{152}Gd	NA	NA	NA	NA
^{3}H	4.0×10^{-8}	2.8×10^{-9}	1.5×10^{-10}	0
^{129}I	6.1×10^{-5}	9.6×10^{-6}	5.1×10^{-7}	1.5×10^{-5}
^{40}K	4.0×10^{-6}	5.7×10^{-7}	3.0×10^{-8}	7.8×10^{-5}
^{22}NA	NA	NA	NA	NA
^{93m}Nb	NA	NA	NA	NA
^{59}Ni	3.5×10^{-7}	4.4×10^{-9}	2.3×10^{-10}	3.4×10^{-7}

Table 4-29. Comparison of Radionuclide Relative Risks or Radionuclides of Concern at the B Plant Aggregate Area. Page 2 of 3

Radionuclide	Air Unit Risk[a/] in $(pCi/m^3)^{-1}$	Drinking Water Unit Risk[b/] in $(pCi/L)^{-1}$	Soil Ingestion Unit Risk[c/] in $(pCi/g)^{-1}$	External Exposure Unit Risk[d/] in $(pCi/g)^{-1}$
^{63}Ni	8.7×10^{-7}	1.2×10^{-8}	6.2×10^{-10}	0
^{237}Np	1.8×10^{-2}	1.4×10^{-5}	7.3×10^{-7}	1.8×10^{-5}
^{231}Pa	2.0×10^{-2}	9.7×10^{-6}	5.1×10^{-7}	2.0×10^{-5}
^{234m}Pa	8.2×10^{-10}	3.0×10^{-10}	1.6×10^{-11}	6.4×10^{-6}
^{209}Pb	3.6×10^{-8}	4.3×10^{-9}	2.3×10^{-10}	0
^{210}Pb	8.7×10^{-4}	3.4×10^{-5}	1.8×10^{-6}	1.8×10^{-6}
^{211}Pb	1.5×10^{-6}	9.2×10^{-9}	4.9×10^{-10}	2.9×10^{-5}
^{214}Pb	1.5×10^{-6}	9.2×10^{-9}	4.9×10^{-10}	1.5×10^{-4}
^{107}Pd	NA	NA	NA	NA
^{143}Pm	NA	NA	NA	NA
^{210}Po	1.4×10^{-6}	1.3×10^{-5}	7.0×10^{-7}	4.8×10^{-9}
^{213}Po	4.1×10^{-15}	1.6×10^{-17}	8.6×10^{-19}	1.7×10^{-8}
^{214}Po	1.4×10^{-13}	5.1×10^{-16}	2.7×10^{-17}	4.7×10^{-8}
^{215}Po	2.9×10^{-12}	1.4×10^{-14}	7.6×10^{-16}	8.7×10^{-8}
^{218}Po	3.0×10^{-7}	1.4×10^{-9}	7.6×10^{-11}	0
^{238}Pu	2.1×10^{-2}	1.4×10^{-5}	7.6×10^{-7}	5.9×10^{-7}
^{239}Pu	2.6×10^{-2}	1.6×10^{-5}	8.4×10^{-8}	2.6×10^{-7}
^{240}Pu	2.1×10^{-2}	1.6×10^{-5}	8.4×10^{-8}	5.9×10^{-7}
^{241}Pu	1.5×10^{-4}	2.5×10^{-7}	1.3×10^{-8}	0
^{242}Pu	2.1×10^{-2}	1.5×10^{-5}	8.1×10^{-8}	4.8×10^{-7}
^{223}Ra	1.6×10^{-3}	4.1×10^{-6}	2.2×10^{-7}	8.4×10^{-5}
^{225}Ra	8.2×10^{-4}	3.4×10^{-6}	1.8×10^{-7}	8.0×10^{-6}
^{226}Ra	1.5×10^{-3}	6.1×10^{-6}	3.2×10^{-7}	4.1×10^{-6}
^{228}Ra	3.4×10^{-4}	5.1×10^{-6}	2.7×10^{-7}	5.6×10^{-13}
^{219}Rn	2.4 x 10-8	--	--	3.5 x 10-5
^{222}Rn	3.7 x 10-7	--	--	2.2 x 10-7
^{106}Ru	2.3×10^{-4}	4.9×10^{-7}	2.6×10^{-8}	0
^{79}Se	NA	NA	NA	NA
^{147}Sm	NA	NA	NA	NA
^{151}Sm	NA	NA	NA	NA

Table 4-29. Comparison of Radionuclide Relative Risks or Radionuclides of Concern at the B Plant Aggregate Area. Page 3 of 3

Radionuclide	Air Unit Risk[a/] in $(pCi/m^3)^{-1}$	Drinking Water Unit Risk[b/] in $(pCi/L)^{-1}$	Soil Ingestion Unit Risk[c/] in $(pCi/g)^{-1}$	External Exposure Unit Risk[d/] in $(pCi/g)^{-1}$
^{90}Sr	2.8×10^{-5}	1.7×10^{-6}	8.9×10^{-8}	0
^{99}Tc	4.2×10^{-6}	6.6×10^{-8}	3.5×10^{-9}	3.4×10^{-10}
^{227}Th	2.5×10^{-3}	2.5×10^{-7}	1.3×10^{-8}	6.6×10^{-6}
^{229}Th	3.9×10^{-2}	2.0×10^{-6}	1.1×10^{-7}	5.8×10^{-5}
^{230}Th	1.6×10^{-2}	1.2×10^{-6}	6.5×10^{-8}	5.9×10^{-7}
^{231}Th	2.5×10^{-7}	2.0×10^{-8}	1.1×10^{-9}	1.1×10^{-5}
^{232}Th	1.6×10^{-2}	1.1×10^{-6}	5.9×10^{-8}	4.5×10^{-7}
^{234}Th	1.6×10^{-3}	2.0×10^{-7}	1.1×10^{-8}	5.6×10^{-6}
^{207}Tl	2.3×10^{-9}	6.6×10^{-10}	3.5×10^{-11}	1.2×10^{-6}
^{233}U	1.4×10^{-2}	7.2×10^{-6}	3.8×10^{-7}	3.2×10^{-7}
^{234}U	1.4×10^{-2}	7.2×10^{-6}	3.8×10^{-7}	5.6×10^{-7}
^{235}U	1.3×10^{-2}	6.6×10^{-6}	3.5×10^{-7}	9.7×10^{-5}
^{236}U	NA	NA	NA	NA
^{238}U	1.2×10^{-2}	6.6×10^{-6}	3.5×10^{-7}	4.5×10^{-7}
^{93}Zr	NA	NA	NA	NA
^{90}Y	2.8×10^{-6}	1.6×10^{-7}	8.6×10^{-9}	0

a/ Excess cancer risk associated with lifetime exposure to 1 pCi/m^3 (10^{-12} curies) per day in air (EPA 1991).

b/ Excess cancer risk associated with lifetime exposure to 1 pCi (10^{-12} curies) per day in drinking water (EPA 1991).

c/ Excess cancer risk associated with lifetime exposure to 1 pCi/g (10^{-12} curies/g) per day in soil (EPA 1991).

d/ Excess cancer risk associated with lifetime exposure to surface soils containing 1 pCi/g of gamma-emitting radionuclides (EPA 1991).

NA No information available.

Table 4-30. Potential Chronic Health Effects of Chemicals Detected or Disposed of at the B Plant Aggregate Area. Page 1 of 2

Chemical	Tumor Site Inhalation Route; Oral Route [Weight of Evidence Group[a]]	Non-carcinogenic Chronic Health Effects Inhalation Route; Oral Route
INORGANIC CHEMICALS		
Arsenic	Respiratory Tract [A];	--
Ammonia	NA	degrades odor; taste of water
Barium	--	fetotoxicity; increased blood pressure
Beryllium	Lung [B2]; Tumors [B2]	NA; none observed
Boron	--	NA; testicular lesions
Cadmium	respiratory tract [B1]; NA	cancer; renal damage
Chromium	lung [A] - Cr(VI) only; NA	nasal mucosa atrophy; hepatotoxicity
Copper	--	NA; gastrointestinal irritation
Cyanide	--	NA; weight loss, thyroid effects, myelin degeneration
Fluoride	--	NA; dental flurosis at high levels
Iron	--	--
Lead	[B2][c]; [B2]	central nervous system (CNS) effects[c]; CNS effects
Manganese	--	respiratory tract; no effect
Mercury	--	neurotoxicity; kidney effects
Nickel	respiratory tract [A]; NA	cancer; reduced weight gain
Nitrate/Nitrite	--	NA; methemoglobinemia in infants[d]
Silver	--	
Sulfuric acid	--	respiratory tract; NA
Tin	--	NA; liver and kidney lesions
Uranium (soluble salts)	--	NA; body weight loss, nephrotoxicity
Zinc	--	NA; anemia

Table 4-30. Potential Chronic Health Effects of Chemicals Detected or Disposed of at the B Plant Aggregate Area. Page 2 of 2

Chemical	Tumor Site Inhalation Route; Oral Route [Weight of Evidence Group[a/]]	Non-carcinogenic Chronic Health Effects Inhalation Route; Oral Route
ORGANIC CHEMICALS	--	--
Acetone	--	NA; kidney and liver effects
1-Butanol	--	NA; effects on erythrocyte
Carbon tetrachloride	liver [B2]	NA; liver lesions
Chloroform	liver; kidney [B2]	NA; liver lesions
Ethyl ether	--	NA; liver effects
Hydrazine	nasal cavity [B2]; liver [B2]	--
Methylene chloride	lung, liver [B2]; liver [B2]	NA; liver toxicity
Methyl ethyl ketone	--	CNS; fetotoxicity
PCBs	NA[B2]; liver [B2]	--
Toluene	--	CNS effects, eye irritation; change in liver and kidney weights
Tributyl phosphate	--	respiratory irritant; kidney damage[b/]

a/ Weight of Evidence Groups for carcinogens: A - Human carcinogen (sufficient evidence of carcinogenicity in humans); B - Probable human carcinogen (B1 - Limited evidence of carcinogenicity in humans; B2 - Sufficient evidence of carcinogenicity in animals with inadequate or lack of data in humans); C - Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data); D - Not classifiable as to human carcinogenicity (inadequate or no evidence).

b/ Verified toxicity information was not available from EPA 1991. Toxicity information was obtained from EPA Registry of Toxic Effects of Chemical Systems (RTECS). A blank space means that no information was available from the above sources.

c/ Lead is considered by EPA to have both neurotoxic and carcinogenic effects; however, no toxicity criteria are available for lead at the present time.

d/ Toxic effect is considered to occur from exposure to nitrite; nitrate can be converted to nitrite in the body by intestinal bacteria.

NA = Information not available.

5.0 HEALTH AND ENVIRONMENTAL CONCERNS

This preliminary qualitative evaluation of potential human health concerns is intended to provide input to the B Plant Aggregate Area waste management unit recommendation process (Section 9.0). This process requires consideration of immediate and long-term impacts to human health and the environment. As discussed in Section 4.2, existing B Plant Aggregate Area and waste management unit data are not adequate to support an evaluation of potential impacts on the environment. Although ecological impacts are an integral part of the complete assessment of aggregate and waste unit potential risks, they cannot be evaluated further at this time. Ecological risk assessment is included in the listing of data needs presented in Section 8.0 with the associated data needs identified as a data gap to be addressed in future investigations. The approach that has been taken to identify potential concerns related to individual waste management units and unplanned releases is as follows:

- Contaminants of potential concern are identified for each exposure pathway that is likely to occur within the B Plant Aggregate Area. Selection of contaminants was discussed in Section 4.2. Contaminants of potential concern were selected from the list of candidate contaminants of potential concern presented in Table 4-22. This table includes contaminants that are likely to be present in the environment based on occurrence in the liquid process wastes that were discharged to soils, and also contaminants that have been detected in environmental samples within the aggregate area but have not been identified as components of B Plant waste streams.

- Exposure pathways potentially applicable to individual waste management units are identified based on the presence of the above contaminants of potential concern in wastes in the waste management units, consideration of known or suspected releases from those waste management units, and the physical and institutional controls affecting site access and use over the period of interest. The relationships between waste management units and exposure pathways are summarized in the conceptual model (Section 4.2).

- Estimates of relative hazard derived for the B Plant waste management units are identified using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hazard Ranking System (HRS), modified Hazard Ranking System (mHRS), surface radiation survey data, and by Westinghouse Hanford Environmental Protection Group scoring.

The human health concerns and various hazard ranking scores listed above are used to establish whether or not a site is considered a "high" priority. In the data evaluation process presented in Section 9.0, "high" priority sites are evaluated for the potential implementation of an interim remedial measure (IRM). "Low" priority sites are evaluated to determine what type of additional investigation is necessary to establish a final remedy. Further detail is presented in Section 9.0.

The data used for this human health evaluation are presented in the earlier sections of this report. The types of data that have been assessed include site histories and physical descriptions (Section 2.0), descriptions of the physical environment of the study area (Section 3.0) and a summary of the available chemical and radiological data for each waste management unit (Section 4.0).

The quality and sufficiency of these data are assessed in Section 8.0. This information is also used to identify applicable or relevant and appropriate requirements (ARARs) (Section 6.0).

5.1 CONCEPTUAL FRAMEWORK FOR RISK-BASED SCREENING

The range of potential human health and environmental exposure pathways at the B Plant Aggregate Area was summarized in Section 4.2. In Section 4.2 the role of biota in transporting contaminants through the environment is also discussed, and biota are included as a receptors in the conceptual model. However, the assessment of potential ecological risks associated with biota exposure to B Plant Aggregate Area contaminants is currently constrained by the lack of data. This gap in the B Plant Aggregate Area data is discussed in Section 8.2.3. As a result, the risk-based screening of waste management unit priorities discussed in this section is by necessity limited to potential human health risks.

The U.S. Environmental Protection Agency (EPA; EPA 1989b) considers a human exposure pathway to consist of four elements: 1) a source and mechanism for contaminant release, 2) a retention or transport medium (or media), 3) a point of potential human contact, and 4) an exposure route (e.g., ingestion) at the contact point. The probability of the existence of a particular pathway is dependent upon the physical and institutional controls affecting site access and use. In the absence of site access controls and other land use restrictions, the identified potential exposure pathways could all occur. For example, it could be hypothesized that an individual could establish a residence within the boundaries of the B Plant Aggregate Area, disrupt the soil surface and contact buried contamination, and drill a well and withdraw contaminated groundwater for drinking water and crop irrigation. However, within the 5- to 10-year period of interest associated with planning and prioritization of remedial actions within the B Plant Aggregate Area, unrestricted access and uncontrolled disruption of buried contaminants have a negligible probability of occurrence. The 5- to 10-year period of interest has been arbitrarily chosen as the timeframe within which most of the critical decisions will be made regarding remediation strategies.

The conceptual model presented in Section 4.2 was evaluated to identify an appropriate framework for screening waste management units and establishing their remediation priorities based on potential health hazards. Based on the 5- to 10-year period of interest for waste unit prioritization, and the presence of site access controls during that period, a screening framework was developed encompassing the range of release mechanisms, affected media, and exposure routes associated with an onsite occupational receptor. While work activities are assumed to include occasional contact with surface soils, it is assumed that no contact with buried contaminants will take place without proper protective measures.

Workers may be exposed via the following routes at the B Plant Aggregate Area:

- Ingestion of surface soils
- Inhalation of volatilized contaminants and resuspended particles
- Direct dermal contact with surface soils
- Direct exposure to radiation from surface soils and airborne resuspended particles.

Since evaluation of migration in the saturated zone is not within the scope of a source area aggregate area management study (AAMS), ingestion or contact with groundwater was not evaluated as an exposure pathways. However, since migration of waste constituents within the saturated zone will be addressed in the 200 East Groundwater AAMS, contaminants likely to migrate to the water table and waste management units that have a high potential to impact groundwater will be identified.

5.2 POTENTIAL EXPOSURE SCENARIOS AND HUMAN HEALTH CONCERNS

The routes by which a Hanford Site worker could potentially be exposed to contamination at the waste management units include ingestion, inhalation, direct dermal contact with surface soils, and direct exposure to radiation. To evaluate the potential for exposure at individual waste management units, it is necessary to have data available for surface soils, air, and radiation levels. Although samples have been collected from each of these media, only the surface radiation survey data (contamination levels and dose rate) are specific to individual waste management units. Therefore, only pathways associated with the surface radiological contamination and external dose rates can be evaluated with confidence at this time. Exposures by other pathways were evaluated based on available knowledge about contaminants disposed of to the waste management unit and the engineered barriers to releases.

5.2.1 External Exposure

External dose rate surveys, which are performed on a waste management unit basis, were used as the measure of a unit's potential for impacting human health through direct external radiation exposure. The contaminants of potential concern for this pathway are the radionuclides that emit moderate to high energy penetrating gamma radiation. The measured dose rates at B Plant Aggregate Area waste management units are presented in Table 5-1 from the available survey data.

For 64 of the 151 B Plant Aggregate Area waste management units listed in Table 5-1, no current radiation survey data are available. For the 87 units that do have radiation survey data of some type, 54 were reported as having no contamination detected.

Westinghouse Hanford manual WHC-CM-4-10, Section 7 (WHC 1988b) was used as the basis for setting one of the criteria that are used to identify waste management units that can be considered high priority sites. The manual indicates that posting ("Radiation Area") and access controls are to be implemented at a level of 2 mrem/h for the purpose of personnel protection. With the same objective in mind, the level of 2 mrem/h is recommended as one of the criteria for distinguishing high priority from lower priority waste management units. The 216-B-8TF Crib, 216-B-11A, and 216-B-11B Reverse Wells were the only units that met or exceeded the 2 mrem/h.

High levels of radiation were reportedly associated with some of the unplanned releases that are listed in Table 5-1. However, many of these releases occurred in the early years of the Hanford Site and more recent survey data are not available. Some of the releases were reportedly remediated by removing contaminated soil for disposal in burial grounds, paving or covering the area with soil, or flushing the soil with water. The effectiveness of the various remediation measures is not known, and confirmatory survey measurements are not available. Thus, with the exception of unplanned releases located within engineered waste units, which are routinely surveyed, information on the current radiological status of remediated unplanned releases is deficient, and is identified as a data gap in Section 8.0.

5.2.2 Ingestion of Soil or Inhalation of Fugitive Dust

Radionuclides and nonradioactive chemicals of concern for the soil ingestion and fugitive dust inhalation pathways are those that are nonvolatile, persistent in surface soils, and have appreciable carcinogenic or toxic affects by ingestion or inhalation. However, little information is available to evaluate the presence of specific radionuclides or nonradioactive chemicals in surface soils. Available gross activity survey data for the B Plant Aggregate Area waste management units are provided in Table 5-1.

The Westinghouse Hanford Environmental Protection group policies state that the presence of any smearable alpha constitutes a potential threat to human health and qualifies a waste management unit for a high remediation priority (Huckfeldt 1991b). Waste management units that exhibit elevated (relative to background) alpha readings in radiological surveys can be presumed to have surface contamination, since alpha radiation cannot penetrate solids.

Westinghouse Hanford manual WHC-CM-4-10 (WHC 1988b) is also used to set criteria for identifying waste management units that can be considered high remediation priority sites. The manual indicates that posting ("Surface Contamination Area") and access controls are to be implemented at a level of 100 ct/min above background beta/gamma, and/or 20 ct/min alpha, for the purpose of personnel protection. These levels are based on the criteria that radiation exposure be maintained "as low as reasonably achievable" (ALARA). With the same objective in mind, the levels of 100 ct/min above background beta/gamma and 20 ct/min alpha are recommended as two of the criteria for identification of high priority waste management units. For those survey readings that are in units of dis/min, a conversion will be made to ct/min assuming a detector efficiency of 10%.

It should be noted that these radiation readings may indicate transient conditions (e.g., presence of contaminated vegetation) and that routine stabilization of surface contamination is carried out under the auspices of the Westinghouse Hanford Radiation Area Remedial Action (RARA) program.

Units subject to collapse of containment structures pose a potential threat of exposure by release of contaminants to the surface. Twelve (12) of the cribs are wooden structures that could fail catastrophically, which could force contaminants from the buried crib to the surface. Additionally, there are 12 trenches that have wooden covers, which also have the potential for collapse. The 216-B-18 Crib experienced a cave-in in 1974 and has since been backfilled with gravel. The 216-B-10A, 216-B-10B, and 216-B-12 Cribs have all subsided several feet. Units with a potential for collapse are identified and evaluated by the Westinghouse Hanford RARA Program, and preventative actions are taken when determined to be appropriate as discussed in Section 9.0.

5.2.3 Inhalation of Volatiles

As summarized in Section 4.1, the distribution of volatile organics in soils is not well-defined in the B Plant Aggregate Area. Although several semivolatile compounds, such as kerosene and tributyl phosphate, have been disposed of in the cribs, no information is available on whether these compounds are still available in the near surface soil column for transport to the soil surface.

The primary volatile radionuclide of concern is tritium. Exposure to tritium (as tritiated water vapor) and the potential for tritium release via radiolytic production of hydrogen from aqueous radioactive wastes is of concern. The mode of disposal of this material can not be determined from available information.

5.2.4 Migration to Groundwater

Risks that could potentially occur due to migration of contaminants in groundwater to existing or potential receptors will be addressed in the 200 East Groundwater AAMS and thus, will not be discussed in the B Plant AAMS. However, the potential for individual units to impact groundwater has been discussed in Section 4.1.

In addition to direct disposal of liquid wastes to the soil column, certain units are known to be the source of subsurface contaminant migration. For example, the septic tanks and drain fields are often located close to other waste management units and are known to generate a significant flux of water through the vadose zone beneath the waste management unit. If lateral migration from either the septic tank or the other waste management unit has occurred, then it is possible that the septic tank discharges are remobilizing contamination adsorbed onto the surface of soil particles. If this is the case, then the septic system could be flushing contaminated water into the aquifer that is more than 100 times the reportable quantity and quality standards.

5.3 ADDITIONAL SCREENING CRITERIA

In addition to determining human health concerns for a worker at each of the waste management units, previously developed site ranking criteria were investigated for the purpose of setting priorities for waste management units and unplanned releases. These criteria are the CERCLA HRS scores assigned during preliminary assessment/site inspection (PA/SI) activities performed for the Hanford Site (DOE 1988), and the rankings assigned by the Westinghouse Hanford Environmental Protection Group to prioritize sites needing remedial actions for radiological control (Huckfeldt 1991b).

Both of these ranking systems take into account some measure of hazard and environmental mobility, and are thus appropriate to consider for waste unit prioritization. The HRS ranking system evaluates sites based on their relative risk, taking into account the population at risk, the hazard potential of the substances at the facility, the potential for contamination of the environment, the potential risk of fire and explosion, and the potential for injury associated with humans or animals that come into contact with the waste management unit inventory. The HRS is thus appropriate to consider for screening waste management units.

The PA/SI screening was performed using the EPA's HRS and mHRS. The HRS (40 CFR 300) is a site ranking methodology which was designed to determine whether sites should be placed on the CERCLA National Priority List (NPL) based on chemical contamination history. The EPA has established the criteria for placement on the NPL to be a score of 28.5 or greater. The mHRS is a ranking system developed by the Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy (DOE) that uses the basic methodology of the HRS; however, it more accurately predicts the impacts from radionuclides. The mHRS takes into account concentration, half-life, and other chemical-specific parameters that are not considered by the HRS. The mHRS has not been accepted by EPA as a ranking system.

Many of the B Plant Aggregate Area waste management units were ranked in the PA/SI using both the HRS and mHRS. For those waste management units that were not ranked in the PA/SI, unit type and discharge history were evaluated in comparison with ranked units for the purpose of setting priorities. If a waste management unit that has been ranked exhibits similar characteristics (e.g., construction, waste type, and volume), the value for the ranked unit was applied to the unit without an HRS or mHRS score. If no ranked waste management units exhibit similar characteristics, then a qualitative high or low ranking was determined through evaluation of unit configuration and contamination history. Table 5-1 lists the HRS and mHRS rankings, as well as the qualitative scores that were assigned for other waste management units. The HRS and mHRS rankings were given equal weight and a high value of either would cause a unit to be rated a high priority.

For the HRS ranking, 19 units of the 151 B Plant Aggregate Area waste management units listed in Table 5-1 were given a score of 28.5 or greater. For the mHRS ranking, 14 units were given a score of 28.5 or greater (all of which also had HRS scores greater than 28.5). Eight (8) units received a qualitative "high" score and 47 units received a qualitative "low" score. Each of the units that received a qualitative "high" HRS and mHRS score were given such a rating based on their discharge history of large quantities of hazardous materials, which could potentially have been transported to the groundwater. The units that received "low" scores were given such a ranking because there is no or little known history of liquid hazardous material disposal that could affect groundwater beneath the B Plant Aggregate Area.

5.4 SUMMARY OF SCREENING RESULTS

The screening process was used to sort sites as either high priority or low priority. Table 5-1 lists the B Plant Aggregate Area waste management units that exceeded one or more of the screening criteria identified in the preceding Sections. In total, 43 units were identified as high priority. Because this screening is preliminary, and just one of the factors considered in evaluating remedial action requirements, each of the screening criteria were given equal weight in the prioritization process. This resulted in a bias for prioritization.

Radiation survey results (dose rate and/or contamination) were available for 87 of the 151 waste management units. Fifty-four (54) were reported as having no detectable results. Of the remaining 33 units, all 33 had survey results that exceeded one or more of the criteria (2 mrem/h, 100 dis/min beta/gamma, and 20 ct/min alpha).

For the HRS scores, 19 waste management units were given scores of 28.5 or greater. For the mHRS, 14 units received a score of 28.5 or greater. Eight (8) units received qualitative "high" scores. Some of the sites were designated as high priority for 2 or more of the criteria, hence 43 total sites are designated high priority.

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys: ct/min	Radiation Surveys: dis/min	Radiation Surveys: mrem/h	Environmental Protection Score	Priority
Tanks and Vaults								
241-B-361B	Settling Tank	Low	Low	NA	NA	NA	--	Low
Crib and Drains								
216-B-7A	Crib	65.43	65.43	--	15,000	1.2	--	High
216-B-7B	Crib	65.43	65.43	--	12,000	1.2	--	High
216-B-8TF	Crib	1.42	1.42	--	6,000 (tumbleweed)	10	--	High
216-B-9TF	Crib	1.03	1.14	NC	NC	NC	10	High
216-B-10A	Crib	47.81	47.81	NC	NC	NC	--	High
216-B-10B	Crib	1.03	0.55	NC	NC	NC	--	Low
216-B-12	Crib	62.92	28.41	NC	NC	NC	--	High
216-B-14	Crib	2.27	2.36	NC	NC	NC	--	Low
216-B-15	Crib	1.36	1.42	NC	NC	NC	--	Low
216-B-16	Crib	62.92	52.20	NC	NC	NC	--	High
216-B-17	Crib	1.36	1.42	NC	NC	NC	--	Low
216-B-18	Crib	1.36	1.42	NC	NC	NC	--	Low
216-B-19	Crib	1.81	1.89	NC	NC	NC	--	Low
216-B-43	Crib	57.88	48.67	--	20,000	--	--	High
216-B-44	Crib	60.40	50.42	--	20,000	--	--	High
216-B-45	Crib	62.92	52.20	--	20,000	--	--	High

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
216-B-46	Crib	62.92	52.20	--	20,000	--	--	High
216-B-47	Crib	1.31	1.42	--	20,000	--	--	High
216-B-48	Crib	62.92	52.20	--	20,000	--	--	High
216-B-49	Crib	62.92	52.20	--	20,000	--	--	High
216-B-50	Crib	50.33	43.70	--	20,000	--	--	High
216-B-55	Crib	Low	Low	--	2,000	--	--	High
216-B-56	Crib	Low	Low	NC	NC	NC	--	Low
216-B-57	Crib	50.33	27.68	NC	NC	NC	--	High
216-B-60	Crib	0.98	1.14	NA	NA	NA	--	Low
216-B-61	Crib	Low	Low	NA	NA	NA	--	Low
216-B-62	Crib	Low	Low	NC	NC	NC	--	Low
TFN 2703E	Drain Field	Low	Low	NA	NA	NA	--	Low
216-B-13	French Drain	0.71	0.71	NC	NC	NC	--	Low
216-B-51	French Drain	0.71	0.71	--	4,000	--	--	High
Reverse Wells								
216-B-4	Reverse Well	47.81	25.74	NC	NC	NC	--	High
216-B-5	Reverse Well	60.40	61.54	--	6,000	--	--	High
216-B-6	Reverse Well	50.33	50.33	NC	NC	NC	--	High
216-B-11A	Reverse Well	47.81	26.32	--	6,000	2	9	High
216-B-11B	Reverse Well	47.81	26.32	--	6,000	2	9	High

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
Ponds, Ditches, and Trenches								
216-B-3	Pond	High	High	--	4,000	--	--	High
216-B-3A	Pond	High	High	NA	NA	NA	--	High
216-B-3B	Pond	High	High	NA	NA	NA	--	High
216-B-3C	Pond	High	High	NA	NA	NA	--	High
216-A-25	Pond	High	High	NC	NC	NC	--	High
216-E-28 CP	Pond	Low	Low	NA	NA	NA	--	Low
216-N-8	Pond	Low	Low	NC	NC	NC	--	Low
216-B-2-1	Ditch	0.00	0.00	NC	20,000	--	--	High
216-B-2-2	Ditch	45.30	30.67	--	20,000	--	--	High
216-B-2-3	Ditch	High	High	--	20,000	--	--	High
216-B-3-1	Ditch	0.00	0.00	NC	NC	NC	--	Low
216-B-3-2	Ditch	0.00	0.00	NC	NC	NC	--	Low
216-B-3-3	Ditch	Low	Low	NC	NC	NC	--	Low
216-B-20	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-21	Trench	1.31	1.42	NC	NC	NC	--	Low
216-B-22	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-23	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-24	Trench	1.31	1.42	NC	NC	NC	--	Low
216-B-25	Trench	1.31	1.42	NC	NC	NC	--	Low

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
216-B-26	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-27	Trench	1.31	1.42	NC	NC	NC	--	Low
216-B-28	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-29	Trench	1.31	1.42	NC	NC	NC	--	Low
216-B-30	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-31	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-32	Trench	1.36	1.42	NC	NC	NC	--	Low
216-B-33	Trench	1.42	1.42	NC	NC	NC	--	Low
216-B-34	Trench	1.42	1.09	NC	NC	NC	--	Low
216-B-35	Trench	1.31	1.42	NC	NC	NC	--	Low
216-B-36	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-37	Trench	1.42	1.42	NC	NC	NC	--	Low
216-B-38	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-39	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-40	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-41	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-42	Trench	1.25	1.42	NC	NC	NC	--	Low
216-B-52	Trench	1.42	1.42	NC	NC	NC	--	Low
216-B-53A	Trench	0.98	0.60	NC	NC	NC	--	Low
216-B-53B	Trench	1.03	1.14	NC	NC	NC	--	Low

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
216-B-54	Trench	1.03	0.82	NC	NC	NC	--	Low
216-B-58	Trench	1.03	1.14	NC	NC	NC	--	Low
216-B-63	Trench	Low	Low	NC	NC	NC	--	Low
Septic Tanks and Associated Drain Fields								
2607-EB	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-EH	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-EK	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-EM	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-EN	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-EO	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-EP	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-EQ	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-ER	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-GF	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-E1	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-E2	Septic Tank	Low	Low	NA	NA	NA	--	Low

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
2607-E3	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-E4	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-E7B	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-E8	Septic Tank/ Drain Field	Low	Low	NA	NA	NA	--	Low
2607-E9	Septic Tank	Low	Low	NA	NA	NA	--	Low
2607-E11	Septic Tank	Low	Low	NA	NA	NA	--	Low
				Basins				
207-B	Retention Basin	High	High	600	--	--	--	High
216-B-59B	Retention Basin	Low	Low	NC	NC	NC	--	Low
216-B-64	Retention Basin	High	High	--	1,000,000	--	--	High
				Burial Sites				
218-E-2	Burial Ground	0.70	0.90	10,000 (tumbleweeds)	--	--	--	High
218-E-2A	Burial Ground	0.00	0.00	NC	NC	NC	--	Low
218-E-3	Burial Ground	0.00	0.00	NA	NA	NA	--	Low
218-E-4	Burial Ground	0.70	0.40	4,000 (tumbleweeds)	--	--	--	High
218-E-5	Burial Ground	0.70	0.80	10,000 (tumbleweeds)	--	--	--	High

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area.

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
218-E-5A	Burial Ground	0.70	0.90	10,000 (tumbleweeds)	--	--	--	High
218-E-6	Burial Ground	0.00	0.00	NA	NA	NA	--	Low
218-E-7	Burial Ground	0.70	0.80	NA	NA	NA	--	Low
218-E-9	Burial Ground	0.00	0.00	10,000 (tumbleweeds)	--	--	--	High
200 Area Construction Pit	Construction Pit	0.00	0.00	NA	NA	NA	--	Low
Unplanned Releases								
UN-200-E-7		1.50	0.00	NA	NA	NA	--	Low
UN-200-E-9		Low	Low	NA	NA	NA	--	Low
UN-200-E-14		Low	Low	NA	NA	NA	--	Low
UN-200-E-41		0.00	0.00	NA	NA	NA	--	Low
UN-200-E-43		1.00	0.00	NA	NA	NA	--	Low
UN-200-E-44		Low	Low	NA	NA	NA	--	Low
UN-200-E-52		1.00	0.00	NA	NA	NA	--	Low
UN-200-E-54		1.00	0.00	NA	NA	NA	--	Low
UN-200-E-55		0.80	0.00	NA	NA	NA	--	Low
UN-200-E-61		Low	Low	NA	NA	NA	--	Low
UN-200-E-63		Low	Low	NA	NA	NA	--	Low
UN-200-E-64		Low	Low	NA	NA	NA	--	Low

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area. Page 8 of 8

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
UN-200-E-69		Low	Low	NA	NA	NA	--	Low
UN-200-E-79		1.20	0.00	NA	NA	NA	--	Low
UN-200-E-80		1.20	0.00	NA	NA	NA	--	Low
UN-200-E-83		0.70	0.00	NA	NA	NA	--	Low
UN-200-E-87		1.00	0.00	NC	NC	NC	--	Low
UN-200-E-90		Low	Low	NA	NA	NA	--	Low
UN-200-E-92		Low	Low	NA	NA	NA	--	Low
UN-200-E-95		0.70	0.00	--	4,000	--	--	High
UN-200-E-101		Low	Low	NC	NC	NC	--	Low
UN-200-E-103		Low	Low	NA	NA	NA	--	Low
UN-200-E-112		0.80	0.00	NA	NA	NA	--	Low
UN-200-E-140		Low	Low	NA	NA	NA	--	Low
UPR-200-E-4		1.10	0.00	NA	NA	NA	--	Low
UPR-200-E-32		1.10	0.00	20,000	--	--	--	High
UPR-200-E-34		Low	Low	NA	NA	NA	--	Low
UPR-200-E-51		Low	Low	NA	NA	NA	--	Low
UPR-200-E-84		1.00	0.00	3,000	--	--	--	High
UPR-200-E-138		Low	Low	NA	NA	NA	--	Low

NA: no data available
NC: no contamination

Table 5-1. Hazard Ranking Scores for B Plant Aggregate Area. Page 8 of 8

Site Name	Site Type	HRS Rating	mHRS Rating	Radiation Surveys ct/min	Radiation Surveys dis/min	Radiation Surveys mrem/h	Environmental Protection Score	Priority
UN-200-E-69		Low	Low	NA	NA	NA	--	Low
UN-200-E-79		1.20	0.00	NA	NA	NA	--	Low
UN-200-E-80		1.20	0.00	NA	NA	NA	--	Low
UN-200-E-83		0.70	0.00	NA	NA	NA	--	Low
UN-200-E-87		1.00	0.00	NC	NC	NC	--	Low
UN-200-E-90		Low	Low	NA	NA	NA	--	Low
UN-200-E-92		Low	Low	NA	NA	NA	--	Low
UN-200-E-95		0.70	0.00	--	4,000	--	--	High
UN-200-E-101		Low	Low	NC	NC	NC	--	Low
UN-200-E-103		Low	Low	NA	NA	NA	--	Low
UN-200-E-112		0.80	0.00	NA	NA	NA	--	Low
UN-200-E-140		Low	Low	NA	NA	NA	--	Low
UPR-200-E-4		1.10	0.00	NA	NA	NA	--	Low
UPR-200-E-32		1.10	0.00	20,000	--	--	--	High
UPR-200-E-34		Low	Low	NA	NA	NA	--	Low
UPR-200-E-51		Low	Low	NA	NA	NA	--	Low
UPR-200-E-84		1.00	0.00	3,000	--	--	--	High
UPR-200-E-138		Low	Low	NA	NA	NA	--	Low

NA: no data available
NC: no contamination

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6.0 IDENTIFICATION OF POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE B PLANT AGGREGATE AREA

6.1 INTRODUCTION

The Superfund Amendments and Reauthorization Act (SARA) of 1986 amended Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to require that all applicable or relevant and appropriate requirements (ARARs) be employed during implementation of a hazardous waste site cleanup. "Applicable" requirements are defined by the Environmental Protection Agency (EPA) in "CERCLA Compliance with Other Laws Manual" (OSWER Directive 9234.1-01, August 8, 1988) as:

> cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

A separate set of "relevant and appropriate" requirements that must be evaluated include:

> cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

"To-be-Considered Materials" (TBCs) are nonpromulgated advisories or guidance issued by federal or state governments that are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs will be considered along with potential ARARs and may be used in determining the necessary level of cleanup for protection of health or the environment.

The following sections identify potential ARARs to be used in developing and assessing various remedial action alternatives at the B Plant Aggregate Area. Specific requirements pertaining to hazardous and radiological waste management, remediation of contaminated soils, surface water protection, and air quality will be discussed.

The potential ARARs focus on federal or state statutes, regulations, criteria, and guidelines. The specific types of potential ARARs evaluated include:

- Contaminant-specific
- Location-specific
- Action-specific.

Contaminant-specific potential ARARs are usually health or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical contaminant values that are generally recognized by the regulatory agencies as allowable to protect human health and the environment. In the case of the B Plant Aggregate Area, contaminant-specific potential ARARs address chemical constituents and/or radionuclides. The potential contaminant-specific ARARs that were evaluated for the B Plant Aggregate Area are discussed in Section 6.2.

Location-specific potential ARARs are restrictions placed on the concentration of hazardous substances, or the conduct of activities, solely because they occur in specific locations. The location-specific potential ARARs that were evaluated for the B Plant Aggregate Area are discussed in Section 6.3.

Action-specific potential ARARs apply to particular remediation methods and technologies, and are evaluated during the detailed screening and evaluation of remediation alternatives. The potential action-specific ARARs that were evaluated for the B Plant Aggregate Area are discussed in Section 6.4.

The TBC requirements are other federal and state criteria, advisories, and regulatory guidance that are not promulgated regulations, but are to be considered in evaluating alternatives. Potential TBCs include U.S. Department of Energy (DOE) Orders that carry out authority granted under the Atomic Energy Act. All DOE Orders are potentially applicable to operations at the B Plant Aggregate Area. Specific TBC requirements are discussed in Section 6.5.

Potential contaminant- and location-specific ARARs will be refined during the AAMS process. Potential action-specific ARARs are briefly discussed in this section, and will be further evaluated upon final selection of remedial alternatives. The points at which these potential ARARs must be achieved and the timing of the ARARs evaluations are discussed in Sections 6.6 and 6.7, respectively.

6.2 CONTAMINANT-SPECIFIC REQUIREMENTS

A contaminant-specific requirement sets concentration limits in various environmental media for specific hazardous substances, pollutants, or contaminants. Based on available information, some of the currently known or suspected contaminants that may be present in the B Plant Aggregate Area are outlined in Table 4-23. The currently identified potential federal and state contaminant-specific ARARs are summarized below.

6.2.1 Federal Requirements

Federal contaminant-specific requirements are specified in several statutes, codified in the U.S. Code (USC), and promulgated in the Code of Federal Regulations (CFR), as follows:

6.2.1.1 Clean Water Act. Federal Water Quality Criteria (FWQC) are developed under the authority of the Clean Water Act to serve as guidelines to the states for determining receiving water quality standards. Different FWQC are derived for protection of human health and protection of aquatic life. The human health FWQC are further subdivided according to how people are expected to use the water (e.g., drinking the water versus consuming fish caught from the water). The SARA 121(d)(2) states that remedial actions shall attain FWQC where they are relevant and appropriate, taking into account the designated or potential use of the water, the media affected, the purpose of the criteria, and current information. Many more substances have FWQC than maximum contaminant levels (MCLs) issued under the Safe Drinking Water Act (see discussion below); consequently, EPA and other state agencies rely on these criteria more than MCLs, even though these criteria can only be considered relevant and appropriate and not applicable.

The FWQC would not be considered at the B Plant Aggregate Area, as no natural surface water bodies exist. The only existing man-made surface water bodies at B Plant Aggregate Area are waste management units.

6.2.1.2 Safe Drinking Water Act. Under the authority of the Safe Drinking Water Act, MCLs apply when the water may be used for drinking. At present, EPA and the State of Washington apply MCLs as the standards for groundwater contaminants at CERCLA sites that could be used as drinking water sources. Groundwater contamination and application of MCLs as potential ARARs are addressed under a separate Aggregate Area Management Study (AAMS) specific to groundwater.

6.2.1.3 Resource Conservation and Recovery Act. The Resource Conservation and Recovery Act (RCRA) addresses the generation and transportation of hazardous waste, and waste management activities at facilities that treat, store, or dispose of hazardous wastes. Subtitle C (Hazardous Waste Management) mandates the creation of a cradle-to-grave management and permitting system for hazardous wastes. The RCRA defines hazardous wastes as "solid wastes" (even though the waste is often liquid in physical form) that may cause or significantly contribute to an increase in mortality or serious illness, or that poses a substantial hazard to human health or the environment when improperly managed. In Washington State, RCRA is implemented by EPA and the authorized state agency, the Washington State Department of Ecology (Ecology).

The RCRA is potentially applicable or relevant and appropriate to the B Plant Aggregate Area. The extensive permitting requirements under RCRA would only apply to a waste management unit that is an identified hazardous waste treatment, storage or disposal (TSD) facility, and to hazardous waste management activities that occurred outside an area of contamination. If a waste management unit is not a RCRA TSD facility and if remediation occurs on site, then the RCRA permitting requirements would not have to be satisfied. However, other substantive requirements necessary to protect human health and the environment would constitute potential ARARs.

Two key contaminant-specific potential ARARs have been adopted under the federal hazardous waste regulations: the Toxicity Characteristic Leaching Procedure (TCLP) designation limits promulgated under 40 CFR Part 261; and the hazardous waste land disposal restrictions for constituent concentrations promulgated under 40 CFR Part 268.

The TCLP designation limits define when a waste is hazardous, and are used to determine when more stringent management standards apply than would be applied to typical solid wastes. Thus, the TCLP contaminant-specific potential ARARs can be used to determine when RCRA waste management standards may be required. The TCLP limits are presented in Table 6-1.

The land disposal restrictions are numerical limits derived by EPA by reviewing available technologies for treating hazardous wastes. Until a prohibited waste can meet the numerical limits, it can be prohibited from land disposal. Two sets of limits have been promulgated: limits for constituent concentrations in waste extract, which uses the TCLP test to obtain a leached sample of the waste; and limits for constituent concentrations in waste, which addresses the total contaminant concentration in the waste. The land disposal restrictions limits are presented in Table 6-1 (see Section 6.4.1.2 for a further discussion on applying the land disposal restriction limits).

6.2.1.4 Clean Air Act. The Clean Air Act establishes National Primary and Secondary Ambient Air Quality Standards (NAAQS) (40 CFR Part 50), National Emission Standards for

Hazardous Air Pollutants (NESHAP)(40 CFR Part 61), and New Source Performance Standards (NSPS)(40 CFR Part 60).

In general, new and modified stationary sources of air emissions must undergo a pre-construction review to determine whether the construction or modification of any source, such as a CERCLA remedial program, will interfere with attainment or maintenance of NAAQS or fail to meet other new source review requirements including NESHAP and NSPS. However, the process applies only to "major" sources of air emissions (defined as emissions of 250 tons per year). The B Plant Aggregate Area would not constitute a major source.

Section 112 of the Clean Air Act directs EPA to establish standards at the level that provides an ample margin of safety to protect the public health from hazardous air pollutants. The NESHAP standards for radionuclides are directly applicable to DOE facilities under Subpart H of Section 112 that establishes a 10 mrem/year facility-wide standard during cleanup of the site. Further, if the maximum individual dose added by a new construction or modification during remediation exceeds 1 percent of the NESHAP standard (0.1 mrem/yr), a report meeting the substantive requirements of an application for approval of construction must be prepared.

6.2.2 State of Washington Requirements

Potential state contaminant-specific requirements are specified in several statutes, codified in the Revised Code of Washington (RCW) and promulgated in the Washington Administrative Code (WAC).

6.2.2.1 Model Toxics Control Act. The Model Toxics Control Act (MTCA) (Ecology 1991) authorized Ecology to adopt cleanup standards for remedial actions at hazardous waste sites. These regulations are considered potential ARARs for soil, groundwater, and surface water cleanup actions. The processes for identifying, investigating, and cleaning up hazardous waste sites are defined and cleanup standards are set for groundwater, soil, surface water, and air in Chapter 173-340 WAC.

Under the MTCA regulations, cleanup standards may be established by one of three methods.

- Method A may be used if a routine cleanup action, as defined in WAC 173-340-200, is being conducted at the site or relatively few hazardous substances are involved for which cleanup standards have been specified by Tables 1, 2, or 3 of WAC 173-340-720 through -745.

- Under Method B, a risk level of 10^{-6} is established and a risk calculation based on contaminants present is determined.

- Method C cleanup standards represent concentrations that are protective of human health and the environment for specified site uses. Method C cleanup standards may be established where it can be demonstrated that such standards comply with applicable state and federal laws, that all practical methods of treatment are used, that institutional controls are implemented, and that one of the following conditions exist: (1) Method A or B standards are below background concentrations; (2) Method A or Method B results in a significantly greater threat to human health or the environment; (3) Method A or Method B standards are below technically possible concentrations, or (4) the site is defined as an industrial site for purposes of soil remediation.

Table 1 of Method A addresses groundwater, so it is not considered to be an ARAR for B Plant Aggregate Area (groundwater will be addressed in the 200 West Groundwater AAMS report). Table 2 of Method A is intended for non-industrial site soil cleanups, and Table 3 of Method A is intended for industrial site soil cleanups. Method A industrial soil cleanup standards for preliminary contaminants of concern are provided as potential ARARs in Table 6-1.

In addition to Method A, Method B and Method C cleanup standards may also be considered potential ARARs for the B Plant Aggregate Area. Method B and Method C cleanup standards can be calculated on a case-by-case basis in concert with Ecology. Method B and Method C should be used where Method A standards do not exist or cannot be met, or where routine cleanup actions cannot be implemented at a specific waste management unit.

6.2.2.2 State Hazardous Waste Management Act and Dangerous Waste Regulations. The State of Washington is a RCRA-authorized state for hazardous waste management, and has developed state-specific hazardous waste regulations under the authority of the State Hazardous Waste Management Act. Generally, state hazardous waste regulations parallel the federal regulations. The state definition of a hazardous waste incorporates the EPA designation of hazardous waste that is based on the compound being specifically listed as hazardous, or on the waste exhibiting the properties of reactivity, ignitability, corrosivity, or toxicity as determined by the TCLP.

In addition, Washington State identifies other waste as hazardous. Three unique criteria are established: toxic dangerous waste; persistent dangerous waste; and carcinogenic dangerous waste. These additional designation criteria may be imposed by Ecology as potential ARARs, for purposes of determining acceptable cleanup standards and appropriate waste management standards.

6.2.2.3 Ambient Air Quality Standards and Emission Limits for Radionuclides (Chapter 173-480 WAC). These Ecology ambient air quality standards specify maximum accumulated dose limits to members of the public.

6.2.2.4 Monitoring and Enforcement of Air Quality and Emission Standards for Radionuclides (WAC 246-247). These permitting requirements by the Washington State Department of Health adopt the Ecology standards for maximum accumulated dose limits to members of the public.

6.2.2.5 Controls for New Sources of Toxic Air Pollutants (Chapter 173-460 WAC). In accordance with regulations recently promulgated by Ecology in Chapter 173-460 WAC, any new emission source will be subject to Toxic Air Pollutant (TAP) emission standards. The regulations establish allowable ambient source impact levels (ASILs) for hundreds of organic and inorganic compounds. Ecology's ASILs may constitute potential ARARs for cleanup activities that have a potential to affect air. The ASILs for preliminary contaminants of concern are provided in Table 6-1.

6.2.2.6 Water Quality Standards. Washington State has promulgated various numerical standards related to surface water and groundwater contaminants. These are included principally in the following regulations:

- **Public Water Supplies (Chapter 248-54 WAC).** This regulation establishes drinking water standards for public water supplies. The standards essentially parallel the federal drinking water standards (40 CFR Parts 141 and 143).

- **Water Quality Standards for Ground Waters of the State of Washington (Chapter 173-200 WAC).** This regulation establishes contaminant standards for protecting existing and future beneficial uses of groundwater through the reduction or elimination of the discharge of contaminants to the state's groundwater.

- **Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201 WAC and Proposed Chapter 173-203/173-201A WAC).** Ecology has adopted numerical ambient water quality criteria for six conventional pollutant parameters for various surface water classes (WAC 173-201-045): (1) fecal coliform bacteria; (2) dissolved oxygen; (3) total dissolved gas; (4) temperature; (5) pH; and (6) turbidity. In addition, toxic, radioactive, or deleterious material concentrations shall be below those of public health significance or which may cause acute or chronic toxic conditions to the aquatic environment or which may adversely affect any water use. Numerical criteria currently exist for a limited number of toxic substances (WAC 173-201-047). Ecology has initiated rulemaking to modify and incorporate additional numerical criteria for toxic substances and for radioactive substances, and to reclassify certain waters of the state.

Under the state Water Quality Standards, the criteria and classifications do not apply inside an authorized mixing zone surrounding a wastewater discharge. In defining mixing zones, Ecology generally follows guidelines contained in "Criteria for Sewage Works Design." Although water quality standards can be exceeded inside the mixing zone, state regulations will not permit discharges that cause mortalities of fish or shellfish within the zone or that diminish aesthetic values.

These water quality standards do not constitute ARARs for purposes of establishing cleanup standards for the B Plant Aggregate Area. Because no natural surface water bodies exist within the B Plant Aggregate Area, there will be no need to achieve ambient water quality standards during remediation activities. Groundwater is being addressed under a separate study in which pertinent groundwater-related potential ARARs will be covered.

The numerical water quality standards cited above may become potential ARARs if selected remedial actions could result in discharges to groundwater or surface water (e.g., if treated wastewaters are discharged to the soil column or the Columbia River). Determining appropriate standards for such discharges will depend on the type of remediation performed and will have to be established on a case-by-case basis as remedial actions are defined.

6.2.3 National Pollutant Discharge Elimination System (Chapter 173-220 WAC and 40 CFR Part 122) and Water Quality Standards.

National Pollutant Discharge Elimination System (NPDES) regulations govern point source discharges into navigable waters. Limits on the concentrations of contaminants and volumetric flowrates that may be discharged are determined on a case-by-case basis and permitted under this program. No point source discharges have been identified. The EPA implements this program in Washington State for federal facilities; however, assumption of the NPDES program by the state is likely within five years.

6.3 LOCATION-SPECIFIC REQUIREMENTS

Location-specific potential ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Table 6-2 lists various location-specific standards and indicates which of these may be potential ARARs. Potential ARARs have been identified as follows:

- **Floodplains.** Requirements for protecting floodplains are not ARARs for activities conducted within the B Plant Aggregate Area. However, remedial actions selected for cleanup may require projects in or near floodplains (e.g., construction of a treatment facility outfall at the Columbia River). In such cases, location-specific floodplain requirements may be potential ARARs.

- **Wetlands, Shorelines, and Rivers and Streams.** Requirements related to wetlands, shorelines, and rivers and streams are not ARARs for activities conducted within the B Plant Aggregate Area. However, remedial actions selected for cleanup may require projects on a shoreline or wetland, or discharges to wetlands (e.g., construction of a treatment facility outfall at the Columbia River). In such cases, location-specific shoreline and wetlands requirements may be potential ARARs.

- **Threatened and Endangered Species Habitats.** As discussed in Section 3.6, various threatened and endangered species inhabit portions of the Hanford Site and may occur in the B Plant Aggregate Area (American peregrine falcon, bald eagle, white pelican, and sandhill crane). Therefore, critical habitat protection for these species would constitute a potential ARAR.

- **Wild and Scenic Rivers.** The Columbia River Hanford Reach is currently undergoing study pursuant to the federal Wild and Scenic Rivers Act. Pending results of this study, actions that may impact the Hanford Reach may be restricted. This requirement would not be an ARAR for remedial activities within the B Plant Aggregate Area. However, Wild and Scenic Rivers Act requirements may be potential ARARs for actions taken as a result of B Plant cleanup efforts that could affect the Hanford Reach.

6.4 ACTION-SPECIFIC REQUIREMENTS

Action-specific potential ARARs are requirements that are triggered by specific remedial actions at the site. These remedial actions will not be fully defined until a remedial approach has been selected. However, the universe of action-specific ARARs defined by a preliminary screening of potential remedial action alternatives will help focus the selection process. Potential action-specific ARARs are outlined below. (Note that contaminant- and location-specific potential ARARs discussed above will also include provisions for action-specific potential ARARs to be applied once the remedial action is selected.)

6.4.1 Federal Requirements

6.4.1.1 Comprehensive Environmental Response, Compensation, and Liability Act. CERCLA, and regulations adopted pursuant to CERCLA contained in the National Contingency Plan (40 CFR Part 300), include selection criteria for remedial actions. Under the criteria, excavation and off-site land disposal options are least favored when on-site treatment options are available. Emphasis is placed on alternatives that permanently treat or immobilize contamination. Selected alternatives must be protective of human health and the environment, which implies that federal and state ARARs be met. However, a remedy may be selected that does not meet all potential ARARs if the requirement is technically impractical, if its implementation would produce a greater risk to human health or the environment, if an equivalent level of protection can otherwise be provided, if state standards are inconsistently applied, or if the remedy is only part of a complete remedial action which attains potential ARARs.

The CERCLA gives state cleanup standards essentially equal importance as federal standards in guiding cleanup measures in cases where state standards are more stringent. State standards pertain only if they are generally applicable, were passed through formal means, were adopted on the basis of hydrologic, geologic, or other pertinent considerations, and do not preclude the option of land disposal by a state-wide ban. Most importantly, CERCLA provides that cleanup of a site must ensure that public health and the environment are protected. Selected remedies should meet all potential ARARs, but issues such as cost-effectiveness must be weighed in the selection process.

6.4.1.2 Resource Conservation and Recovery Act. The RCRA, and regulations adopted pursuant to RCRA, describe numerous action-specific requirements that may be potential ARARs for cleanup activities. The primary regulations are promulgated under 40 CFR Parts 262, 264, and 265, and include such action-specific requirements as:

- Packaging, labeling, placarding, and manifesting of off-site waste shipments

- Inspecting waste management areas to ensure proper performance and safe conditions

- Preparation of plans and procedures to train personnel and respond to emergencies

- Management standards for containers, tanks, incinerators, and treatment units

- Design and performance standards for land disposal facilities

- Groundwater monitoring system design and performance.

Many of these requirements will depend on the particular remediation activity undertaken, and will have to be identified as remediation proceeds.

One key potential area of action-specific RCRA ARARs are the 40 CFR Part 268 land disposal restrictions. In addition to the contaminant-specific constituent concentration limits established in the land disposal restrictions (as previously discussed in Section 6.2.1.3), EPA has identified best demonstrated available treatment technologies (BDATs) for various waste streams. The EPA could require the use of BDATs prior to allowing land disposal of wastes generated during remediation. The EPA's imposition of the land disposal restrictions and BDAT requirements will depend on various factors.

Applicability to CERCLA actions is based on determinations of waste "placement/disposal" during a remediation action. According to OSWER Directive 9347.3-05FS, EPA concludes that Congress did not intend in situ consolidation, remediations, or improvement of structural stability to constitute placement or disposal. Placement or disposal would be considered to occur if:

- Wastes from different units are consolidated into one unit (other than a land disposal unit within an area of contamination)

- Waste is removed and treated outside a unit and redeposited into the same or another unit (other than a land disposal unit within an area of contamination)

- Waste is picked up from a unit and treated within the area of contamination in an incinerator, surface impoundment, or tank and then redeposited into the unit (except for in situ treatment).

Consequently, the requirement to use BDAT would not apply under the land disposal restrictions standards unless placement or disposal had occurred. However, remediation actions involving excavation and treatment could trigger the requirements to use BDAT for wastes subject to the land disposal restrictions standards. In addition, the agencies could consider BDAT technologies to be relevant and appropriate when developing and evaluating potential remediation technologies.

Two additional components of the land disposal restrictions program should be considered with regard to an excavate and treat remedial action. First, a national capacity variance was issued by EPA for contaminated soil and debris for a two-year period ending May 8, 1992 (54 FR 26640). Second, a series of variances and exemptions may be applied under an excavate and treat scenario. These include:

- A no-migration petition
- A case-by-case extension to an effective date
- A treatability variance
- Mixed waste provisions of a federal Facilities Compliance Act (when enacted).

The applicability and relevance of each of these options will vary based on the specific details of a B Plant Aggregate Area excavate and treat option. An analysis of these variances can be developed once engineering data on the option becomes available.

The effect of the land disposal restrictions program on mixed waste management is significant. Currently, limited technologies are available for effective treatment of these waste streams and no commercially available treatment facilities exist except for liquid scintillation counting fluids used for laboratory analysis and testing. The EPA recognized that inadequate capacity exists and issued a national capacity variance until May 8, 1992, to allow for the development of such treatment capacity.

Lack of treatment and disposal capacity also presents implications for storage of these materials. Under 40 CFR 268.50, mixed wastes subject to land disposal restrictions may be stored for up to one year. Beyond one year, the owner/operator has the burden of proving such storage is for accumulating sufficient quantities for treatment. On August 29, 1991, EPA issued a mixed waste storage enforcement policy providing some relief from this provision for generators of small volumes of mixed wastes. However, the policy was limited to facilities generating less than 28 m^3 (1,000 ft^3) of land disposal-prohibited waste per year. Congress is considering amendments to RCRA postponing the storage prohibition for another five years; however, final action on these amendments has not occurred.

6.4.1.3 Clean Water Act. Regulations adopted pursuant to the Clean Water Act under the NPDES mandate use of best available treatment technologies prior to discharging contaminants to surface waters. The NPDES requirements would not be ARARs for actions conducted only within the B Plant Aggregate Area. However, NPDES requirements could constitute potential ARARs for cleanup actions which would result in discharge of treated wastewaters to the Columbia River, and associated treatment systems could be required to utilize best available treatment technologies.

6.4.1.4 Department of Transportation Standards. The Department of Transportation standards contained in 40 CFR 171-177 specify the requirements for packaging, labeling, and placarding for offsite transport of hazardous materials. These standards ensure that hazardous substances and wastes are safely transported using adequate means of transport and with proper documentation.

6.4.1.5 Occupational Health and Safety Administration Standards. The Occupational Health and Safety Administration requirements contained in 29 CFR 1910 outline standards for provision of safe and healthful places of employment for workers. Section 1910.120 specifically addresses standards for workers engaged in hazardous waste operations and emergency response, and includes detailed standards on the procedures and equipment required.

6.4.2 State of Washington Requirements

6.4.2.1 Hazardous Waste Management. As discussed in Section 6.4.1.2, there are various requirements addressing the management of hazardous wastes that may be potential action-specific ARARs. Pertinent Washington regulations appear in Chapter 173-303 WAC and generally parallel federal management standards. Determination of potential ARARs will be on a case-by-case basis as cleanup actions proceed.

6.4.2.2 Solid Waste Management. Washington State regulations describe management standards for solid waste in Chapter 173-304 WAC. Some of these management standards may be potential ARARs for disposal of cleanup wastes within the B Plant Aggregate Area. Solid waste standards include such requirements as:

- Inspecting waste management areas to ensure proper performance and safe conditions

- Management standards for incinerators and treatment units

- Design and performance standards for landfills

- Groundwater monitoring system design and performance.

Many of these requirements will depend on the particular remediation activity undertaken, and will have to be identified as remediation proceeds.

6.4.2.3 Water Quality Management. Chapter 90.48 RCW, the Washington State Water Pollution Control Act, requires use of all known, available, and reasonable treatment technologies for treating contaminants prior to discharge to waters of the state. Implementing regulations appear principally at Chapters 173-216, 173-220, and 173-240 WAC.

The Water Pollution Control Act requirements for groundwater could be potential ARARs for actions conducted within the B Plant Aggregate Area if such actions would result in discharge of liquid contaminants to the soil column. In this event, Ecology may require use of all known, available, and reasonable treatment technologies to treat the liquid discharges prior to soil disposal.

The Water Pollution Control Act requirements for surface water would not be ARARs for actions conducted only within the B Plant Aggregate Area. However, these requirements could constitute potential ARARs for cleanup actions which would result in discharge of treated wastewaters to the Columbia River and associated treatment systems could be required to demonstrate they meet all known, available, and reasonable treatment technologies.

6.4.2.4 Air Quality Management. The Toxic Air Pollutant regulations for new air emission sources, promulgated in Chapter 173-460 WAC, require use of best available control technology for air toxics. The Toxic Air Pollutant regulations may be potential ARARs for cleanup actions at the B Plant Aggregate Area that could result in emissions of toxic contaminants to the air. Ecology may require the use of best available control technology for air toxics, to treat such air emissions.

6.5 OTHER CRITERIA AND GUIDANCE TO BE CONSIDERED

In addition to the potential ARARs presented, other federal and state criteria, advisories, guidance, and similar materials are TBC in determining the appropriate degree of remediation for the B Plant Aggregate Area. A myriad of resources may be potentially evaluated. The following represents an initial assessment of pertinent TBC provisions.

6.5.1 Health Advisories

The EPA Office of Drinking Water publishes advisories identifying contaminants for which health advisories have been issued.

6.5.2 International Commission of Radiation Protection/National Council on Radiation Protection

The International Commission of Radiation Protection (ICRP) and the National Council on Radiation Protection (NCRP) have a guidance standard of 100 mrem/yr whole body dose of gamma radiation. These organizations also issue recommendations on other areas of interest regarding radiation protection.

6.5.3 EPA Proposed Corrective Actions for Solid Waste Management Units

In the July 27, 1990, federal register (55 FR 30798), EPA published proposed regulations for performing corrective actions (cleanup activities) at solid waste management units associated with RCRA facilities. The proposed 40 CFR Part 264 Subpart S include requirements that would be TBCs for determining an appropriate level of cleanup at the B Plant Aggregate Area. In particular, EPA included an appendix, "Appendix A - Examples of Concentrations Meeting Criteria for Action Levels", which presented recommended contaminant concentrations warranting corrective action. These contaminant-specific TBCs are included in Table 6-1 for the preliminary contaminants of concern.

6.5.4 DOE Standards for Radiation Protection

A number of DOE Orders exist which could be TBCs. The DOE Orders that establish potential contaminant-specific or action-specific standards for the remediation of radioactive wastes and materials are discussed below.

6.5.4.1 DOE Order 5400.5 - DOE Standards for Radiation Protection of the Public and Environment. The DOE Order 5400.5 establishes the requirements for DOE facilities to protect the environment and human health from radiation including soil and air contamination. The purpose of the Order is to establish standards and requirements for operations of the DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation.

The Order mandates that the exposure to members of the public from a radiation source as a consequence of routine activities shall not exceed 100 mrem from all exposure sources due to routine DOE activities. In accordance with the Clean Air Act, exposures resulting from airborne emissions shall not exceed 10 mrem to the maximally exposed individual at the facility boundary. The DOE Order 5400.5 provides Derived Concentration Guide (DCG) values for releases of radionuclides into the air or water. The DCG values are calculated so that, under conditions of continuous exposure, an individual would receive an effective dose equivalent of 100 mrem/year. Because dispersion in air or water is not accounted for in the DCG, actual exposures of maximally exposed individuals in unrestricted areas are considerably below the 100 mrem/year level.

The DOE Order 5400.5 also provides for establishment of soil cleanup levels through a site-specific pathway analysis such as the allowable residual contamination level method. The calculation of allowable residual contamination level values for radionuclides is dependent on the physical characteristics of the site, the radiation dose limit determined to be acceptable, and the scenarios of human exposure judged to be possible and to result in the upper-bound exposure.

6.5.4.2 DOE Order 5820.2A - Radioactive Waste Management. The DOE Order 5820.2A applies to all DOE contractors and subcontractors performing work that involves management of waste containing radioactivity. This Order requires that wastes be managed in a manner that assures protection of the health and safety of the public, operating personnel, and the environment. The DOE Order 5820.2A establishes requirements for management of high-level, transuranic, and low-level wastes as well as wastes containing naturally occurring or accelerator produced radioactive material, and for decommissioning of facilities. The requirements applicable to the B Plant Aggregate Area remediation activities include those related to transuranic waste and low-level radioactive waste. These are summarized below.

6.5.4.2.1 Management of Transuranic Waste. Transuranic waste resulting from the B Plant Aggregate Area remedial action must be managed to protect the public and worker health and safety, and the environment, and performed in compliance with applicable radiation protection standards and environmental regulations. Practical and cost-effective methods must be used to reduce the volume and toxicity of transuranic (TRU) waste.

Transuranic waste must be certified in compliance with the Waste Isolation Pilot Plant (WIPP) Acceptance Criteria, placed in interim storage, if required, and sent to the WIPP. Any transuranic waste that the DOE has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation provided by a geologic repository or transuranic waste that cannot be certified or otherwise approved for acceptance at the WIPP must be disposed of by alternative methods. Alternative disposal methods must be approved by DOE Headquarters and comply with NEPA requirements and EPA/state regulations.

6.5.4.2.2 Management of Low-Level Radioactive Waste. The requirements for management of low-level radioactive waste presented in DOE Order 5820.2A are relevant to the remedial alternative of removal and disposal of B Plant Aggregate Area wastes. Performance objectives for this option shall ensure that external exposure to the radioactive material released into surface water, groundwater, soil, plants, and animals does not result in an effective dose greater than 25 mrem/yr to the public. Releases to the environment shall be at levels as low as reasonably achievable. An inadvertent intruder after the institutional control period of 100 years is not to exceed 100 mrem/yr for continuous exposure or 500 mrem for a single acute exposure. A performance assessment is to be prepared to demonstrate compliance with the above performance objectives.

Other requirements under DOE Order 5820.2A which may affect remediation of the B Plant Aggregate Area include waste volume minimization, waste characterization, waste acceptance criteria, waste treatment, and shipment. The low-level radioactive waste may be stored by appropriate methods prior to disposal to achieve the performance objectives discussed above. Disposal site selection, closure/post-closure, and monitoring requirements are also discussed in this Order.

6.6 POINT OF APPLICABILITY

A significant factor in the evaluation of remedial alternatives for the B Plant Aggregate Area will be the determination of the point at which compliance with identified ARARs must be achieved (i.e., the point of a specific ARAR's applicability). These points of applicability are the boundaries at which the effectiveness of a particular remedial alternative will be assessed.

For most individual radioactive species transported by either water or air, Ecology and Health standards generally require compliance at the boundaries of the Hanford Site. The assumed point of compliance for radioactive species is the point where a member of the public would have unrestricted access to live and conduct business, and, consequently, to be maximally exposed. Although Health is responsible for monitoring and enforcing the air standards promulgated by Ecology, and generally recognizes the site boundary as the point of applicability, Ecology has recently indicated that compliance may be required at the point of emission.

The point at which compliance with identified ARARs must be achieved will be a significant factor in evaluating appropriate remedial alternatives in the B Plant Aggregate

Area. Applicability of ARARs at the point of discharge, at the boundary of the disposal unit, at the boundary of the AAMS, at the boundary of the Hanford Site, and/or at the point of maximum exposure will need to be determined.

6.7 ARARs EVALUATION

Evaluation of ARARs is an iterative process that will be conducted at multiple points throughout the remedial process:

- When the public health evaluation is conducted to assess risks at the B Plant Aggregate Area, the contaminant-specific ARARs and advisories and location-specific ARARs will be identified more comprehensively and used to help determine the cleanup goals

- During detailed analysis of alternatives, all the ARARs and advisories for each alternative will be examined to determine what is needed to comply with other laws and to be protective of public health and the environment.

Following completion of the investigation, the remedial alternative selected must be able to attain all ARARs unless one of the six statutory waivers provided in Section 121 (d)(4)(A) through (f) of CERCLA is invoked. Finally, during remedial design, the technical specifications of construction must ensure attainment of ARARs. The six reasons ARARs can be waived are as follows:

- The remedial action is an interim measure, where the final remedy will attain ARARs upon completion.

- Compliance will result in greater risk to human health and the environment than will other options.

- Compliance is technically impracticable.

- An alternative remedial action will attain the equivalent performance of the ARAR.

- For state ARARs, the state has not consistently applied (or demonstrated the intention to consistently apply) the requirements in similar circumstances.

- For CERCLA-financed actions under Section 104, compliance with the ARAR will not provide a balance between the need for protecting public health, welfare, and the environment at the facility, and the need for fund money to respond to other sites (this waiver is not applicable at the Hanford Site).

Table 6-1. Potential Contaminant-Specific ARARs and TBCs for Preliminary Inorganic and Organic Contaminants of Concern. Page 1 of 2

	RCRA TCLP Designation Limits	RCRA Land Ban Limits		MTCA Method A Cleanup Levels Industrial Soil	Toxic Air Pollutants (ASIL)	RCRA Corrective Action Levels (Proposed)[a/]	
	in mg/L	CCWE in mg/L	CCW in mg/kg	in mg/kg	in $\mu g/m^3$	Air in $\mu g/m^3$	Soil in mg/kg
INORGANIC CHEMICALS							
Ammonia (Anhydrous)	–	–	–	–	59.9[b/]	–	–
Arsenic	5.0	5.0	–	200.0	0.00023[c/]	.00007	80.0
Barium	100.0	100.0	–	–	1.7[b/]	–	–
Berylium	–	–	–	–	0.00042[c/]	0.004	0.02
Boron	–	–	–	–	–	–	–
Cadmium	1.0	1.0	–	10.0	0.00056[c/]	0.0006	40.0
Chromium	5.0	5.0 (Total)	–	500.0	0.000083[c/]	0.00009	400.0
Copper	–	–	–	–	3.3[b/]	–	–
Cyanide	–	–	590 (Total)	–	16.7	–	–
Fluoride	–	–	–	–	8.3[b/]	–	–
Iron	–	–	–	–	–	–	–
Lead	5.0	5.0	–	1,000.0	–	–	–
Manganese	–	–	–	–	16.7	–	–
Mercury	0.2	0.20 (low-level)	–	1.0	0.3[b/]	–	20.0
Nickel	–	134	–	–	3.3[b/]	–	2000.0
Nitric Acid	–	–	–	–	16.7[b/]	–	–
Nitrite	–	–	–	–	–	–	–
Silver	5.0	5.0	–	–	0.3	–	200.0
Sulfuric Acid	–	–	–	–	3.3[b/]	–	–
Tin	–	–	–	–	6.7	–	–
Uranium	–	–	–	–	0.7	–	–
Zinc	–	–	–	–	–	–	–
ORGANIC CHEMICALS							
Acetone	–	–	5.9	–	5927.4[b/]	–	8000.00
1-Butanol	–	–	–	–	–	–	–
Carbon Tetrachloride	0.5	.96	–	–	0.067	0.03	5.0

Table 6-1. Potential Contaminant-Specific ARARs and TBCs for Preliminary Inorganic and Organic Contaminants of Concern. Page 2 of 2

	RCRA TCLP Designation Limits	RCRA Land Ban Limits		MTCA Method A Cleanup Levels Industrial Soil	Toxic Air Pollutants (ASIL)	RCRA Corrective Action Levels (Proposed)[a]	
	in mg/L	CCWE in mg/L	CCW in mg/kg	in mg/kg	in $\mu g/m^3$	Air in $\mu g/m^3$	Soil in mg/kg
Chloroform	6.0	--	5.6	--	0.0430[c]	0.04	100.0
Ethyl ether	--	--	--	--	--	--	--
Hydrazine	--	--	--	--	--	0.0002	0.2
Kerosene	--	--	--	--	--	--	--
Methyl Ethyl Ketone	200.0	--	36	--	1964.7[c]	300.0	4000.0
Methylene Chloride	--	.33	.96	0.5	--	0.3	90.
MIBK ("Hexone")	--	.33	.33	--	682.7	--	--
PCBs	--	--	--	10.0	--	--	--
Toluene	--	.33	.28	40	1248.8	7000.0	2000.0
Tributyl Phosphate	--	--	--	--	8.3[b]	--	--
1,1,1-Trichloroethane	--	.014	5.6	20.0	149.9	1000.0	7000.0

ASIL = Acceptable Source Impact Level
CCWE = Constituent Concentration in Waste Extract
CCW = Constituent Concentration in Waste
MTCA = Washington State Model Toxics Control Act
RCRA = Federal Resource Conservation and Recovery Act
TCLP = Toxic Characteristic Leaching Procedure
WAC = Washington Administrative Code

mg/L = milligrams per liter
mg/kg = milligrams per kilogram
$\mu g/m^3$ = micrograms per cubic meter

[a] RCRA Corrective Action Levels are only proposed at this time (40 CFR Part 264 Subpart S), so are not ARARs yet; they are "To Be Considered."
[b] 24-hour average
[c] Annual average

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
GEOLOGICAL:				
Within 61 m (200 ft) of a fault displaced in Holocene time.	New treatment, storage or disposal of hazardous waste prohibited.	Hazardous waste management near Holocene fault.	40 CFR 264.18; WAC 173-303-420	Not ARAR. No Holocene fault.
Holocene faults and subsidence areas.	New solid waste disposal facilities prohibited over faults with displacement in Holocene time, and in subsidence areas.	New solid waste management activities near Holocene fault.	WAC 173-304-130	Not ARAR. No Holocene fault.
Unstable slopes.	New solid waste disposal areas prohibited from hills with unstable slopes.	New solid waste disposal on an unstable slope.	WAC 173-304-130	Not ARAR. No unstable slope.
100-year floodplains.	Solid and hazardous waste disposal facilities must be designed, built, operated, and maintained to prevent washout.	Solid or hazardous waste disposal in a 100-year floodplain.	40 CFR 264.18; WAC 173-303-420; WAC 173-304-460	Potential ARAR.
	Avoid adverse effects, minimize potential harm, restore/preserve natural and beneficial values in floodplains.	Actions occurring in a floodplain.	40 CFR Part 6 Subpart A; 16 USC 661 et seq; 40 CFR 6.302	Potential ARAR.
Salt dome and salt bed formations, underground mines, and caves.	Placement of non-containerized or bulk liquid hazardous wastes is prohibited.	Hazardous waste placement in salt dome, salt bed, mine, or cave.	40 CFR 264.18	Not ARAR. None of these units.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
SURFACE WATER:				
Wetlands.	New hazardous waste disposal facilities prohibited in wetlands (including within 61 m (200 ft) of shoreline).	Hazardous waste disposal within 61 m (200 ft) of surface water.	WAC 173-303-420	Potential ARAR.
	New solid waste disposal facilities prohibited within 61 m (200 ft) of surface water (stream, lake, pond, river, salt water body).	Solid waste disposal within 61 m (200 ft) of surface water.	WAC 173-304-130	Potential ARAR.
	New solid waste disposal facilities prohibited in wetlands (swamps, marshes, bogs, estuaries, and similar areas).	Solid waste disposal in a wetland (swamp, marsh, bog, estuary, etc.).	WAC 173-304-130	Not ARAR. No wetlands present.
	Discharge of dredged or fill materials into wetlands prohibited without a permit.	Discharges to wetlands and navigable waters.	40 CFR Part 230; 33 CFR Parts 303, and 320 to 330	Potential ARAR.
	Minimize potential harm, avoid adverse effects, preserve and enhance wetlands.	Construction or management of property in wetlands.	40 CFR Part 6 Appendix A	Not ARAR. No wetlands present.
Shorelines.	Actions prohibited within 61 m (200 ft) of shorelines of statewide significance unless permitted.	Actions near shorelines.	Chapter 90.58 RCW; Chapter 173-14 WAC.	Potential ARAR.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
Rivers and streams.	Avoid diversion, channeling or other actions that modify streams or rivers, or adversely affect fish or wildlife habitats and water resources.	Actions modifying a stream or river and affecting fish or wildlife.	40 CFR 6.302	Potential ARAR.
GROUNDWATER:				
Sole source aquifer.	New solid and hazardous waste land disposal facilities prohibited over a sole source aquifer.	Disposal over a sole source aquifer.	WAC 173-303-402; WAC 173-304-130	Not ARAR. No sole source aquifer.
Uppermost aquifer.	Bottom of lowest liner of new solid waste disposal facility must be at least 3 m (10 ft) above seasonal high water in uppermost aquifer 1.5 m (5 ft) if hydraulic gradient controls installed).	New solid waste disposal.	WAC 173-304-130	Not ARAR. Groundwater is deeper than 3 m (10 ft).
Aquifer Protection Areas.	Activities restricted within designated Aquifer Protection Areas.	Activities within an Aquifer Protection Area.	Chapter 36.36 RCW.	Not ARAR. Not an Aquifer Protection Area.
Groundwater Management Areas.	Activities restricted within Ground Water Management Areas.	Activities within a Groundwater Management Area.	Chapter 90.44 RCW; Chapter 173-100 WAC	Not ARAR. Not a Groundwater Management Area.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
DRINKING WATER SUPPLY:				
Drinking water supply well.	New solid waste disposal areas prohibited within 305 m (1,000 ft) upgradient, or 90 days travel time, of drinking water supply well.	New solid waste disposal within 305 m (1,000 ft) of drinking water supply well.	WAC 173-304-130	Not ARAR. No drinking water supply wells.
Watershed.	New solid waste disposal areas prohibited within a watershed used by a public water supply system for municipal drinking water.	New solid waste disposal in a public watershed.	WAC 173-304-130	Not ARAR. Not a public watershed.
AIR:				
Non-attainment areas.	Restrictions on air emissions in areas designated as non-attainment areas under state and federal air quality programs.	Activities in a designated non-attainment area.	Chapter 70.94 RCW; Chapters 173-400 and 173-403 WAC.	Not ARAR. Not a non-attainment area.
SENSITIVE ENVIRONMENTS:				
Endangered/threatened species habitats.	New solid waste disposal prohibited from areas designated by US Fish and Wildlife Service as critical habitats for endangered/threatened species.	New solid waste disposal in critical habitats.	WAC 173-304-130	Not ARAR. Not a critical habitat.
	Actions within critical habitats must conserve endangered/threatened species.	Activities where endangered or threatened species exist.	50 CFR Parts 200 and 402.	Potential ARAR.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
Parks.	No new solid waste disposal areas within 305 m (1,000 ft) of state or national park.	New solid waste disposal near state/national park.	WAC 173-304-130	Not ARAR. No state/national park.
	Restrictions on activities in areas that are designated state parks, or recreation/ conservation areas.	Activities in state parks or recreation/conservation areas.	Chapter 43.51 RCW; Chapter 352.32 WAC	**Not ARAR. None of these state areas.**
Wilderness areas.	Actions within designated wilderness areas must ensure area is preserved and not impaired.	Activities within designated wilderness areas.	16 USC 1131 et seq; 50 CFR 35.1 et seq	Not ARAR. Not a wilderness area.
Wildlife refuge.	Restrictions on actions in areas that are part of the National Wildlife Refuge System.	Activities within designated wildlife refuges.	16 USC 668dd et seq; 50 CFR Part 27	Not ARAR. Not a wildlife refuge.
Natural areas preserves.	Activities restricted in areas designated as having special habitat value (Natural Heritage Resources).	Activities within identified Natural Area Preserves.	Chapter 79.70 RCW; Chapter 332-650 WAC	Not ARAR. Not a Natural Area Preserve.
Wild, scenic, or recreational rivers.	Avoid actions that would have adverse effects on designated wild, scenic, or recreational rivers.	Activities near wild, scenic, and recreational rivers.	16 USC 1271 et seq; 40 CFR 6.302; Chapter 79.72 RCW	Potential ARAR.
Columbia River Gorge	Restrictions on activities that could affect resources in the Columbia River Gorge.	Activities within the Columbia River Gorge.	Chapter 43.97 RCW	Not ARAR. Not in Columbia River Gorge.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
UNIQUE LANDS AND PROPERTIES:				
Natural resource conservation areas.	Restrictions on activities within designated Conservation Areas.	Activities within designated Conservation Areas.	Chapter 79.71 RCW	Not ARAR. Not a Conservation Area.
Forest lands.	Activities restricted within state forest lands to minimize fire hazards and other adverse impacts.	Activities within state forest lands.	Chapter 76.04 RCW; Chapter 332-24 WAC	Not ARAR. Not a forest land.
	Restrictions on activities in state and federal forest lands.	Activities within state and federal forest lands.	16 USC 1601; Chapter 76.09 RCW	Not ARAR. Not a forest land.
Public lands.	Activities on public lands are restricted, regulated, or proscribed.	Activities on state-owned lands	Chapter 79.01 RCW	Not ARAR. Not a state land.
Scenic vistas.	Restrictions on activities that can occur in designated scenic areas.	Activities in designated scenic vista areas.	Chapter 47.42 RCW	Not ARAR. Not a scenic area.
Historic areas.	Actions must be taken to preserve and recover significant artifacts, preserve historic and archaeologic properties and resources, and minimize harm to national landmarks.	Activities that could affect historic or archaeologic sites or artifacts.	16 UST 469, 470 et seq; 36 CFR Parts 65 and 800; Chapters 27.34, 27.53, and 27.58 RCW.	Not ARAR. No historic or archaeologic sites.

Table 6-2. Potential Location-Specific ARARs.

Location	Requirement	Prerequisite	Citation	ARAR
LAND USE:				
Neighboring properties.	No new solid waste disposal areas within 30.5 m (100 ft) of the facility's property line.	New solid waste disposal within 100 feet of facility property line.	WAC 173-304-130	Not ARAR. Not near facility boundary.
	No new solid waste disposal areas within 76 m (250 ft) of property line of residential zone properties.	New solid waste disposal within 250 feet of property line of residential property.	WAC 173-304-130	Not ARAR. No residential property near.
Proximity to airports.	Disposal of garbage that could attract birds prohibited within 3,048 m (10,000 ft) (turbojet aircraft)/1,524 m (5,000 ft) (piston-type aircraft) of airport runways.	Garbage disposal near airport.	WAC 173-304-130	Not ARAR. No airports near.

7.0 PRELIMINARY REMEDIAL ACTION TECHNOLOGIES

Previous sections identified contaminants of concern at the B Plant Aggregate Area, potential routes of exposure, and applicable or relevant and appropriate requirements (ARARs). Section 7.0 identifies preliminary remedial action objectives (RAOs) and develops preliminary remedial action alternatives consistent with reducing the potential hazards of this contamination and satisfying ARARs. The overall objective of this section is to identify viable and innovative remedial action alternatives for media of concern at the B Plant Aggregate Area.

The process of identifying viable remedial action alternatives consists of several steps. In Section 7.1, RAOs are first identified. Next, in Section 7.2, general response actions are determined along with specific treatment, resource recovery, and containment technologies within the general response categories. Specific process options belonging to each technology type are identified, and these process options are subsequently screened based on their effectiveness, implementability, and cost (Section 7.3). The combining of process options into alternatives occurs in Section 7.4. Here the alternatives are described and diagrammed. Criteria are then identified in Section 7.5 for preliminary screening of alternatives that may be applicable to the waste management units and unplanned release sites identified in the B Plant Aggregate Area. Figure 7-1 is a matrix summarizing the development of the remedial action alternatives starting with media-specific RAOs.

Because of uncertainty regarding the nature and extent of contamination at the B Plant Aggregate Area waste management units, recommendations for remedial alternatives are general and cover a broad range of actions. Remedial action alternatives will be considered and more fully developed in future focused feasibility studies. The *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) is used to focus the range of remedial action alternatives that will be evaluated in focused studies. In general, the *Hanford Site Past-Practice Strategy* remedial investigation (RI)/feasibility study (FS) and the Resource Conservation Recovery Act (RCRA)/Corrective Measures Studies are defined as the combination of interim remedial measures (IRMs), limited field investigations (LFIs) for final remedy selection where interim actions are not clearly justified, and focused or aggregate area feasibility/treatability studies for further evaluation of treatment alternatives. After completion of an IRM, data will be evaluated including concurrent characterization and monitoring data to determine if a final remedy can be selected.

A secondary purpose of the evaluation of preliminary remedial action alternatives is the identification of additional information needed to complete the evaluation. This information may include field data needs and treatability tests of selected technologies. Additional data will be developed for most sites or waste groups during future data gathering activities (e.g., LFIs, characterization supporting IRMs, or treatability studies). These data may be used to refine and supplement the RAOs and proposed alternatives identified in this initial study. Data needs are defined in Section 8.0. Alternatives involving technologies that are not well-demonstrated under the conditions of interest are identified in Sections 7.3 and 7.5. These technologies may require bench-scale and pilot-scale treatability studies. The intent is to conduct treatability studies for promising technologies early in the RI/FS process. Conclusions regarding the feasibility of some individual technologies may change after new data become available.

The bias-for-action philosophy of addressing contamination at the Hanford Site requires an expedited process for implementing remedial actions. Implementation of general response actions may be accomplished using an observational or "learn-as-you-go" approach. This observational approach is an iterative process of data acquisition and refinement of the conceptual model. Data needs are determined by the model, and data collected to fulfill these needs are used as additional input to the model. Use of the observational approach while conducting response actions in the 200 Areas will allow integrating these actions with longer range objectives of final remediation of similar areas and the entire 200 Areas. Site characterization and remediation data will be collected concurrently with the use of LFIs, IRMs, and treatability testing. The knowledge gained through these different activities will be applied to similar areas. The overall goal of this approach is convergence on an appropriate response action as early as possible while continuing to obtain valuable characterization information during remediation phases.

7.1 PRELIMINARY REMEDIAL ACTION OBJECTIVES

The RAOs are remediation goals for protection of human health and the environment that specify the contaminants and media of concern, exposure pathways, and allowable contaminant levels. The RAOs discussed in this section are considered to be preliminary and may change or be refined as new data are acquired and evaluated.

The fundamental objective of the corrective action process at the B Plant Aggregate Area is to protect environmental resources and/or human receptors from the potential threats that may exist because of known or suspected contamination. Specific interim and final RAOs will depend in part on current and reasonable potential future land use in the B Plant Aggregate Area and the 200 Areas.

Potential future land use will affect the risk-based cleanup objectives, potential ARARs, and point of compliance. The RAOs for protecting human health for residential or agricultural land use would be based on risk assessment exposure scenarios requiring cleanup to lower contaminant levels than for recreational or industrial land uses. It is important that potential future land use and the RAOs be clearly defined and agreed upon by the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) before further and more detailed evaluation of remedial actions. The Hanford Site Remedial Action Environmental Impact Statement is intended to resolve the land use issues. A Record of Decision (ROD) for this environmental impact statement is expected in the spring of 1994.

To focus remedial actions with a bias for action through implementing IRMs, preliminary RAOs are identified for the 200 Areas and B Plant Aggregate Area. The overall objective for the 200 Areas is as follows:

> Reduce the risk of harmful effects to the environment and human users of the area by reducing the toxicity, mobility, or volume of contaminants from the source areas to meet ARARs or risk-based levels that will allow industrial use of the area (this is a potential final RAO, and an interim action objective based on current use of the 200 Area).

The RAOs are further developed in Table 7-1 for media of concern and applicable exposure pathways (see Sections 4.1 and 4.2) for the B Plant Aggregate Area. The media of concern for the B Plant Aggregate Area include:

- Radiation contaminated soils that could result in direct exposure or inhalation
- Contaminated soils that are or could contribute to groundwater contamination
- Vadose zone vapors that could cause ambient air impacts or contribute to the lateral and vertical migration of contaminants in the soil and to the groundwater
- Biota that could mobilize radionuclides or chemical contaminants and could thereby degrade the integrity of other controls, such as caps.

Waste materials currently stored in single-shell tanks that contribute or may contribute contaminants to environmental media will not be addressed by this aggregate area management study (AAMS) program but rather by the single-shell tank program. In addition, groundwater as an exposure medium is not addressed in this source AAMS report but will be addressed in the 200 West Groundwater Aggregate Area Management Study Report.

7.2 PRELIMINARY GENERAL RESPONSE ACTIONS

General response actions represent broad classes of remedial measures that may be appropriate to achieve both interim and final RAOs at the B Plant Aggregate Area, and are presented in Table 7-2. The following are the general response actions followed by a brief description for the B Plant Aggregate Area:

- No action (applicable to specific facilities)
- Institutional controls
- Waste removal and treatment or disposal
- Waste containment
- In situ waste treatment
- Combinations of the above actions.

No action is included for evaluations as required by the National Environmental Policy Act and National Contingency Plan [40 CFR 300.68 (f)(l)(v)] to provide a baseline for comparison with other response actions. The no action alternative may be appropriate for some facilities and sources of contamination if risk assessments determine acceptable natural resource or human health risks posed by those sources or facilities and no exceedances of contaminant-specific ARARs occur.

Institutional controls involve the use of physical barriers or access restrictions to reduce or eliminate public exposure to contamination. Considering the nature of the B Plant Aggregate Area and the 200 Areas as a whole, institutional controls will likely be an integral component of all interim remedial alternatives. Many access and land use restrictions are currently in place at the Hanford Site and will remain in place during implementation of remedial actions. Institutional controls may also be important for final remedial measures alternatives. The decisions regarding future long-term land use at the 200 Areas will be important in determining whether institutional controls will be a part of the remedial measures alternative, and the type of controls required.

Waste removal and treatment or disposal involves excavation of contamination sources for eventual treatment and/or disposal either on a small- or large-scale basis. One approach being considered for large-scale waste removal is macro-engineering, which is based on high volume excavation using conventional surface mining technologies. Waste removal on a macro-engineering scale would be used over large areas such as groups of waste management units, operable units, or operational areas as a final remedial action. Waste removal on a small scale would be conducted for individual waste management units on a selective basis. Small-scale waste removal could be conducted as either an interim or final remedial action. One potential problem with offsite disposal is the lack of an alternate disposal location that will decrease the potential human exposure over the long time required for many of the contaminants. Waste removal actions may not be needed, or only be required on a small scale, to protect human health or the environment for industrial uses of the 200 Areas.

Waste treatment involves the use of biological, thermal, physical, or chemical technologies. Typical treatment options include biological land farming, thermal processing, soil washing, and fixation/solidification/stabilization. Some treatment technologies may be pilot tested at the highest priority facilities. Waste treatment could be conducted either as an interim or final action and may be appropriate in meeting RAOs for all potential future land uses.

Waste containment includes the use of capping technologies (i.e., capping and grouting) to minimize the driving force for downward or lateral migration of contaminants. Capping also provides a radiation exposure barrier and barrier to direct exposure. In addition, these barriers provide long-term stability with relatively low maintenance requirements. Containment actions may be appropriate for either interim or final remedial actions.

In situ waste treatment includes thermal, chemical, physical, and biological technology types, of which there are several specific process options including in situ vitrification, in situ grouting or stabilization, soil flushing, and in situ biotreatment. The distinguishing feature of in situ treatment technologies is the ability to attain RAOs without removing the wastes. The final waste form generally remains in place. This feature is advantageous when exposure during excavation would be significant or when excavation is technically impractical. In situ treatment can be difficult because the process conditions may not be easily controlled.

In the next section, specific process options within these technology groups are evaluated.

7.3 TECHNOLOGY SCREENING

In this section, potentially applicable technology types and process options are identified. These process options are then screened using effectiveness, implementability, and relative cost as criteria to eliminate those process options that would not be feasible at the site. The remaining applicable processes are then grouped into remedial alternatives in Sections 7.4.

The effectiveness criteria focuses on: (1) the potential effectiveness of process options in handling the areas or volumes of media and meeting the remedial action objectives; (2) the potential impacts to human health and the environment during the construction and implementation phase; and (3) how proven and reliable the process is with respect to the contaminants and conditions at the site. This criteria also concentrates on the ability of a process option to treat a contaminant type (organics, inorganics, metals, radionuclides, etc.) rather than a specific contaminant (nitrate, cyanide, chromium, plutonium, etc.).

The implementability criteria places greater emphasis on the institutional aspects of implementability, such as the ability to obtain necessary permits for offsite actions, the availability of treatment, storage, and disposal services, and the availability of necessary equipment and skilled workers to implement the technology. It also focuses on the process option's developmental status, whether it is an experimental or established technology.

The relative cost criteria is an estimate of the overall cost of a process, including capital and operating costs. At this stage in the process, the cost analysis is made on the basis of engineering judgement, and each process is evaluated as to whether costs are high, medium, or low relative to other process options.

A process option is rated effective if it can handle the amount of area or media required with reasonable effort, if it does not impact human health or the environment during the construction and implementation phases, and if it is a proven or reliable process with respect to the contaminants and conditions at the site. Also a process option is considered more effective if it treats a wide range of contaminants rather than a specific contaminant. An example of a very effective process option would be vitrification because it treats inorganics, metals, and radionuclides. On the other hand, chemical reduction may only treat chromium (VI), making it a less useful option.

An easily implemented process option is one that is an established technology, uses readily available equipment and skilled workers, uses treatment, storage, and disposal services that are readily available, and has few regulatory constraints. Preference is given to technologies that are easily implemented.

Preference is given to lower cost options, but cost is not an exclusionary criteria. A process option is not eliminated based on cost alone.

Results of the screening process are shown in Table 7-3. Brief descriptions are given of the process options, followed by comments regarding the evaluation criteria. The last column of the table indicates whether the process option is rejected or carried forward for possible alternative formation. The table first lists technologies that address soil RAOs.

Next, technologies pertaining to biota RAOs are presented. All the biota-specific technologies happen to be technologies that were listed for soil RAOs. Air RAOs are dealt with as soil remediation issues because the air contamination is a result of the contaminants in the soil: addressing and remediating the air pathways would be unnecessary and ineffective as long as there is soil contamination. If the soil is remediated, the source of the air contamination would be removed.

The conclusions column of Table 7-3 indicates that no action, monitoring, 3 institutional process options, and 16 other process options are retained for further development of alternatives. These options are carried forward into the development of preliminary alternatives.

7.4 PRELIMINARY REMEDIAL ACTION ALTERNATIVES

This section develops and describes several remedial alternatives considered applicable to disposal sites that contain hazardous chemicals, radionuclides, and volatile organic compounds (VOCs). These alternatives are not intended as recommended actions for any individual site, but are intended only to provide potential options applicable to most sites where multiple contaminants are present. Selection of actual remedial alternatives that should be applied to the individual sites would be partly based on future expedited or interim actions and LFIs, as recommended in Section 9.0 of this report. Selection of proper alternatives would be conducted within the framework of the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) and the strategy outlined in Section 9.4.

The remedial alternatives are developed in Section 7.4.1. Then, in Section 7.4.2 through Section 7.4.7, the remedial action alternatives are described. Detailed evaluations and costs are not provided because site-specific conditions must be further investigated before meaningful evaluations could be conducted.

7.4.1 Development of Remedial Alternatives

Potentially feasible remedial technologies were described and evaluated in Section 7.3. Some of those technologies have been proven to be effective and constructible at industrial waste sites, while other technologies are in the developmental stages. EPA guidance on feasibility studies for uncontrolled waste management units recommends that a limited number of candidate technologies be grouped into "Remedial Alternatives." For this study, technologies were combined to develop remedial alternatives and provide at least one alternative for each of the following general strategies:

- No action
- Institutional controls
- Removal, above-ground treatment, and disposal
- Containment
- In situ treatment.

The alternatives are intended to treat all or a major component of the B Plant Aggregate Area contaminated waste management units or unplanned releases. Consistent with the development of RAOs and technologies, alternatives were developed based on treating classes of compounds (radionuclides, heavy metals, inorganics, and organics) rather than specific contaminants. At a minimum, the alternative must be a complete package. For example, disposal of radionuclide-contaminated soil must be combined with excavation and backfilling of the excavated site.

One important factor in the development of the preliminary remedial action alternatives is the fact that radionuclides, heavy metals, and some inorganic compounds cannot be destroyed. Rather, these compounds must be physically immobilized, contained, isolated, or chemically converted to less mobile forms to satisfy RAOs. Organic compounds can be destroyed, but may represent a smaller portion of the overall contamination at the B Plant Aggregate Area. Both no action and institutional controls are required as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) RI/FS guidance. The purpose of including both of these alternatives is to provide decision makers with information on the entire range of available remedial actions.

For the containment alternative, an engineered multimedia cover, with or without vertical barriers (depending on the specifics of the remediation) was selected. Two alternatives were selected to represent the excavation and treatment strategy. One of these deals with disposal of transuranic (TRU) contaminated soils. Finally, three in situ alternatives were identified. One deals with vapor extraction for VOCs, one with stabilization of soils and the other with vitrification of soils.

It is recognized that this does not represent an exhaustive list of all applicable alternatives. However, these do provide a reasonable range of remedial actions that are likely to be evaluated in future feasibility studies. The remedial action alternatives are summarized as follows:

- No action
- Institutional controls
- Engineered multimedia cover with or without vertical barriers (containment)
- In situ grouting or stabilization of soil (in situ treatment)
- Excavation, above-ground treatment, and disposal of soil (removal, treatment and disposal)
- In situ vitrification of soil (in situ treatment)
- Excavation, treatment, and geologic disposal of soil with TRU radionuclides (removal, treatment and disposal)
- In situ soil vapor extraction of VOCs (in situ treatment).

These alternatives, with the exception of no action and institutional controls, were developed because they satisfy a number of RAOs simultaneously and use technologies that are appropriate for a wide range of contaminant types. For example, constructing an engineered multimedia cover can effectively contain radionuclides, heavy metals, inorganic compounds, and organic compounds simultaneously. It satisfies the RAOs of protecting human health and the environment from exposures from contaminated soil, bio-mobilization, and airborne contaminants. In situ soil vapor extraction is more contaminant-specific than the other alternatives, but it addresses a contaminant class (VOCs) that is not readily treated using the other options, such as in situ stabilization. It is possible that some waste management units may require a combination of the identified alternatives to completely address all contaminants.

The use of contaminant-specific remedial technologies was avoided because there appear to be few, if any, waste management units where a single contaminant has been identified. It is possible to construct alternatives that include several contaminant-specific technologies, but the number of combinations of technologies would result in an unmanageable number of alternatives. Moreover, the possible presence of unidentified contaminants may render specific alternatives unusable. Alternatives may be refined as more contamination data are acquired. For now, the alternatives will be directed at remediating the major classes of compounds (radionuclides, heavy metals, inorganics, and organics).

In all alternatives except the no-action alternative, it is assumed that monitoring and institutional controls are required, although they may be temporary. These features are not explicitly mentioned, and details are purposely omitted until a more detailed evaluation may be performed in subsequent studies.

In the next sections, the preliminary remedial action alternatives are described in more detail, with the exception of the no-action and institutional control options.

7.4.2 Alternative 1--Engineered Multimedia Cover with or without Vertical Barriers

Alternative 1 consists of an engineered multimedia cover. Vertical barriers such as grout curtains or slurry walls may be used in conjunction with the cover. Figure 7-2 shows a schematic diagram of an engineered multimedia cover without the vertical barriers. If the affected area includes either a naturally-occurring or engineered depression, then imported backfill would be placed to control runoff and run-on water. The engineered cover itself may consist of clay, gravel, sand, asphalt, soil, and/or synthetic liners. A liquid collection layer could also be included. The specific design of the cover and vertical barriers would be the subject of a focused feasibility study which may be supported by performance testing. The barrier would be designed to minimize infiltration of surface water by enhancing the evapotranspiration mechanism. The covered area may be fenced, and warning signs may be posted.

Alternative 1 would provide a permanent cover over the affected area. The cover would accomplish the following: minimize or eliminate the migration of precipitation into the affected soil; reduce the migration of windblown dust that originated from contaminated surface soils; reduce the potential for direct exposure to contaminated soils; and reduce the volatilization of VOCs and tritium to the atmosphere. If vertical barriers are included, they would limit the amount of lateral migration of contaminants.

7.4.3 Alternative 2--In Situ Grouting or Stabilization of Soil

Radioactive and hazardous soil would be grouted in this alternative using in situ injection methods to significantly reduce the leachability of hazardous contaminants, radionuclides and/or VOCs from the affected soil. Grouting may also be used to fill voids, such as in cribs, thereby reducing subsidence. Another variation of this alternative would be to stabilize the soil using in-situ mixing of soil with stabilizing compounds such as pozzolanics or fly ash.

Figure 7-3 shows a schematic diagram of the in situ grout injection process. Grouting wells would be installed and screened throughout the affected vertical zones. Specially formulated cement grout (determined by treatability studies) would be injected and allowed to cure. In-situ stabilization would be conducted in a similar manner, except a cutting-head tool would be used to mix the contaminated soil with stabilizing compounds fed into the soil.

Alternative 2 would provide a combination of immobilization and containment of heavy metal, radionuclide, and inorganic contamination. Thus, this alternative would reduce migration of precipitation into the affected soil; reduce the migration of windblown dust that originated from contaminated surface soils; reduce the potential for direct exposure to contaminated soils; and reduce the volatilization of VOCs.

7.4.4 Alternative 3--Excavation, Soil Treatment, and Disposal

Under Alternative 3, radioactive and hazardous soil would be excavated using conventional techniques, with special precautions to minimize fugitive dust generation. The soil would be treated above ground. Several treatment options could be selected from the physical, chemical, and thermal treatment process options screened in Section 7.3. For example, thermal desorption with off gas treatment could be used if organic compounds are present; soil washing could be used to remove contaminated silts and sands or specific compounds; and stabilization could be used to immobilize radionuclides and heavy metals. The specific treatment method would depend on site-specific conditions (determined in part through bench-scale testing). The treated soil would be backfilled into the original excavation or landfilled. Soil treatment by-products may require additional processing or treatment. Figure 7-4 shows a schematic diagram of this alternative.

Alternative 3 would be effective in treating a full range of contamination, depending on the type of treatment processes selected. Attainment of soil RAOs would depend on the depth to which the soil was excavated. If near surface soil was treated, airborne contamination, direct exposure to contaminated soil, and bio-mobilization of contamination would be minimized. Because of practical limits on deep excavation, deep contamination may not be removed and would be subject to migration into groundwater. Alternative 3 could be used in conjunction with Alternative 1 (multimedia cap) to reduce this possibility.

7.4.5 Alternative 4--In Situ Vitrification of Soil

In this alternative, the contaminated soil in a subject site would be immobilized by in situ vitrification. Figure 7-5 shows a schematic diagram of the alternative. Import fill would initially be placed over the affected area to reduce exposures to the remediation workers from surface contamination. High power electrodes would be used to vitrify the contaminated soil under the site to a depth below where contamination is present. A large fume hood would be constructed over the site before the start of the vitrification process to collect and treat emissions. After completion of the vitrification, the site would be built back to original grade with imported backfill. Fences and warning signs may be placed around the vitrified monolith to minimize disturbance and potential exposure.

In situ vitrification would be effective in treating radionuclides, heavy metals, and inorganic contamination and may also destroy organic contaminants. This would reduce the potential for exposures by leaching to groundwater, windblown dust and direct dermal contact. However, this alternative would not reduce the mass or toxicity of the radionuclides present onsite.

In situ vitrification has not currently been tested below about 6 m (20 ft) and may not be adequate to immobilize deep contamination without further technological improvement.

7.4.6 Alternative 5--Excavation, Above-Ground Treatment, and Geologic Disposal of Soil with TRU Radionuclides

Figure 7-6 shows a schematic diagram of Alternative 5. Special excavation procedures would have to be used to minimize fugitive dust. Non-TRU "overburden" may have to be removed, temporarily stored, and returned to the excavation after the TRU soil was removed. Imported backfill would be used to restore the site to original grade. The excavated TRU soil would be vitrified or stabilized by an above-ground treatment plant. The vitrified or stabilized soil would then be shipped to a TRU waste repository. Long-term storage may be required until a suitable facility could be sited and constructed. An engineered multimedia cover (Alternative 1) could be installed over the completed site to reduce exposure to any remaining contaminated, non-TRU soils.

For Alternative 5, soil containing TRU radionuclides at concentrations exceeding 100 nCi/g would be excavated, treated, and disposed. Thus, potential exposure to and migration of TRU-wastes would be minimized. Potential exposure to other contaminants would be determined by other remedial alternatives implemented. At sites containing TRU and non-TRU wastes, the use of Alternative 5 alone may not satisfy all RAOs.

7.4.7 Alternative 6--In Situ Soil Vapor Extraction for VOCs

Figure 7-7 shows a schematic diagram of a representative soil vapor extraction system. The soil vapor extraction system would consist of venting wells, manifold piping, condensed water collectors, high efficiency particulate air (HEPA) filters, and a catalytic oxidizer. The condensed water may contain VOCs and radionuclides, so it may have to be disposed of as radioactive mixed waste. The vented air may contain radionuclide-containing dust particles, so HEPA filters would be installed to remove the particulate radionuclides. The vented vapors would be treated by the catalytic incinerator to provide at least 95% destruction. Because there are few sites containing VOCs in the B Plant Aggregate Area, the potential use of soil vapor extraction in this aggregate area would be limited.

In situ soil vapor extraction is a proven technology for removal of VOC from the vadose zone soils. Soil vapor extraction would reduce downward migration of the VOC vapors through the vadose zone, and thereby minimize potential cross-media migration into the groundwater. Soil vapor extraction would reduce upward migration of VOC through the soil column into the atmosphere, and thereby minimize inhalation exposures to the contaminants. In some cases the radionuclides were discharged to the disposal sites with VOCs (e.g., hexone). Removal of the VOC by implementing soil vapor extraction could reduce the mobility of the radionuclides, and thereby reduce the potential for downward migration of the radionuclides. Finally, soil vapor extraction would enhance partitioning of the VOC off of the soil and into the vented air stream, resulting in the permanent removal and destruction of the VOC. Alternative 6 may be used in conjunction with other alternatives if contaminants other than VOCs are present. However, because of the limited number of B Plant waste management units that contain VOCs, the use of soil vapor extraction will not be extensive.

7.5 PRELIMINARY REMEDIAL ACTION ALTERNATIVES APPLICABLE TO WASTE MANAGEMENT UNITS AND UNPLANNED RELEASE SITES

The purpose of this section is to discuss which preliminary remedial action alternatives could be used to remediate each B Plant Aggregate Area waste management unit or unplanned release site. The criteria used for deciding this are as follows:

- Installing an engineered multimedia cover with or without vertical barriers (Alternative 1) could be used on any site where contaminants may be leached or mobilized by surface water infiltration or if surface/near-surface contamination exists.

- In situ grouting or stabilization (Alternative 2) could be used on any waste management unit or unplanned release site that contain heavy metals, radionuclides, and/or other inorganic compounds. In situ grouting could also be effective in filling voids for subsidence control. Suitable sites are underground contaminated waste zones as opposed to surface contamination.

- Excavation and soil treatment (Alternative 3) could be used at most waste management units or unplanned release sites that contain radionuclides, heavy metals, other inorganics compounds, and/or semi-volatile organic compounds. Surface contamination sites were considered suitable with the maximum applicable depth to be determined on a case-by-case basis.

- In situ vitrification (Alternative 4) could be used at most waste management unit or unplanned release sites, although vapor extraction may be needed when VOCs are present. Waste management units or unplanned release sites where in situ vitrification may not be effective include reverse wells and other sites where the contamination is present in a very narrow geometry, at deep locations, or at surface-only contamination sites.

- Excavation, treatment, and geologic disposal of TRU-containing soils (Alternative 5) could be used only on those sites that contain TRU radionuclides. Since a geologic repository is likely to accept only TRU radioactive soils, non-TRU radioactive soils will not be remediated using this alternative.

- In situ soil vapor extraction (Alternative 6) could be used on any waste management unit or unplanned release sites that contains volatile organic compounds. Such sites are not common in the B Plant Aggregate Area. Nonetheless, the 216-B-63 Ditch to which the chemical sewer is directed with high probabilities of VOC contamination is one waste management unit at which soil vapor extraction would be an effective remedy.

Using these criteria, Table 7-4 was created showing possible preliminary remedial action alternatives that could be used to remediate each of the waste management units and unplanned release sites. Table 7-4 excludes units and releases that will be addressed by other programs. For example, single-shell tanks are excluded because they will be addressed by the single-shell tank program. Note that a single alternative may not be sufficient to remediate all contamination at a single site. For example, soil vapor extraction to remove organic contaminants could precede in situ vitrification. Also, different combinations of technologies are possible besides those presented in these preliminary alternatives.

Each waste management unit or unplanned release site may require just one alternative or a combination of many alternatives. Furthermore, similar units or releases may be remediated simultaneously. Also more specific waste treatment alternatives could be identified and evaluated as more information is obtained.

Technology development studies will be needed for the in situ vitrification process, and treatability studies will be needed for the in situ grouting or stabilization process, and for soil treatment processes to make sure that they will effectively remediate the contaminants. Specifically, organic waste mobility may be a problem for in situ vitrification; grouting agents and the resulting reduction of contaminant leachability will need to be determined before in situ grouting can be performed; and appropriate treatment protocols and systems will need to be identified before soil washing can be used. Capping, soil vapor extraction, and disposal options are all proven processes but may require site-specific performance assessment (treatability) studies.

Focused feasibility studies will be required to evaluate alternative designs for all of the alternatives evaluated, as they relate to the specific waste management unit being remediated. A site-by-site economic evaluation is also required before making a decision. This evaluation will require site-specific information obtained in LFIs and focused feasibility studies.

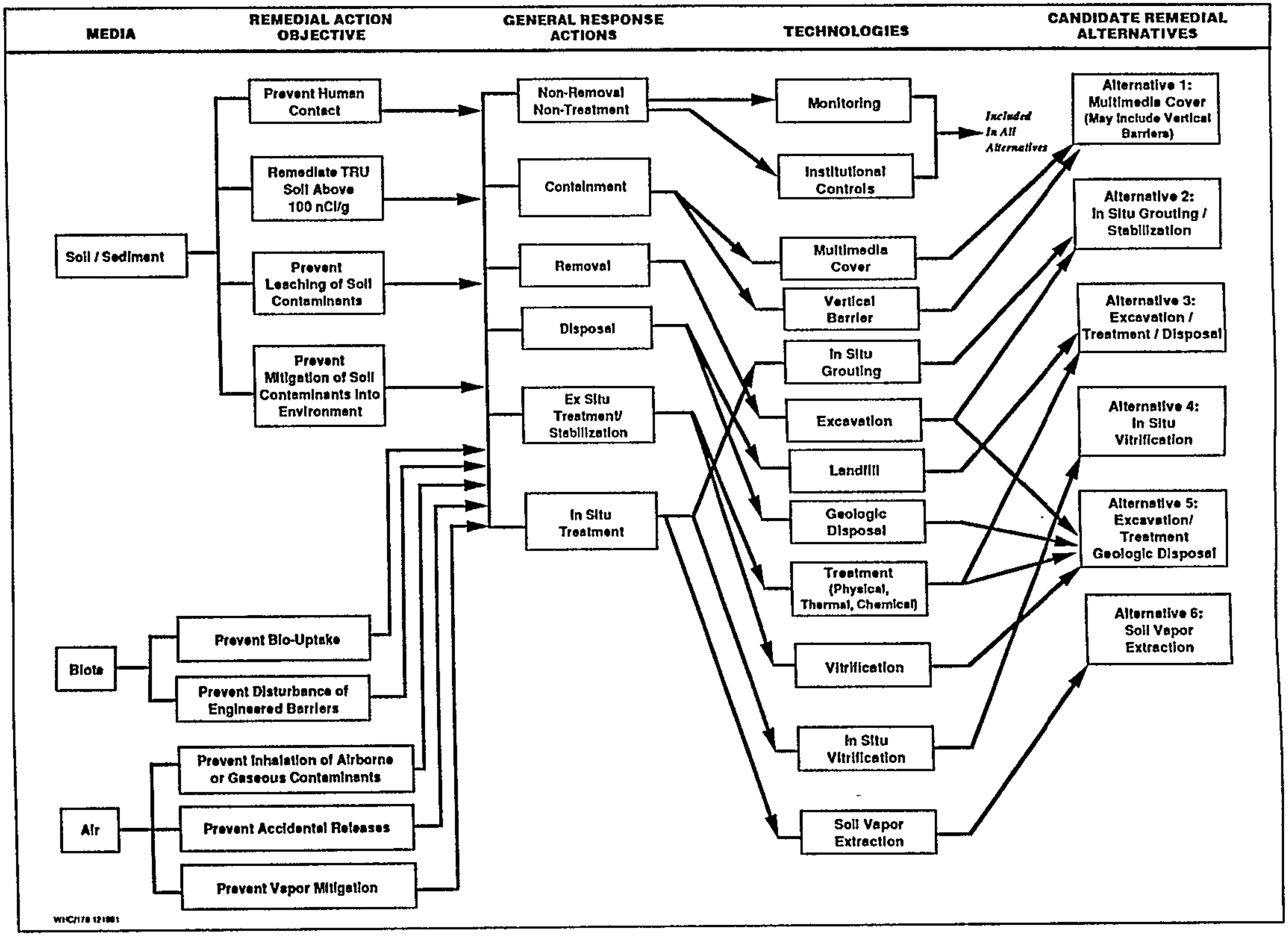

Figure 7-1. Development of Candidate Remedial Alternatives for B Plant Aggregate Area.

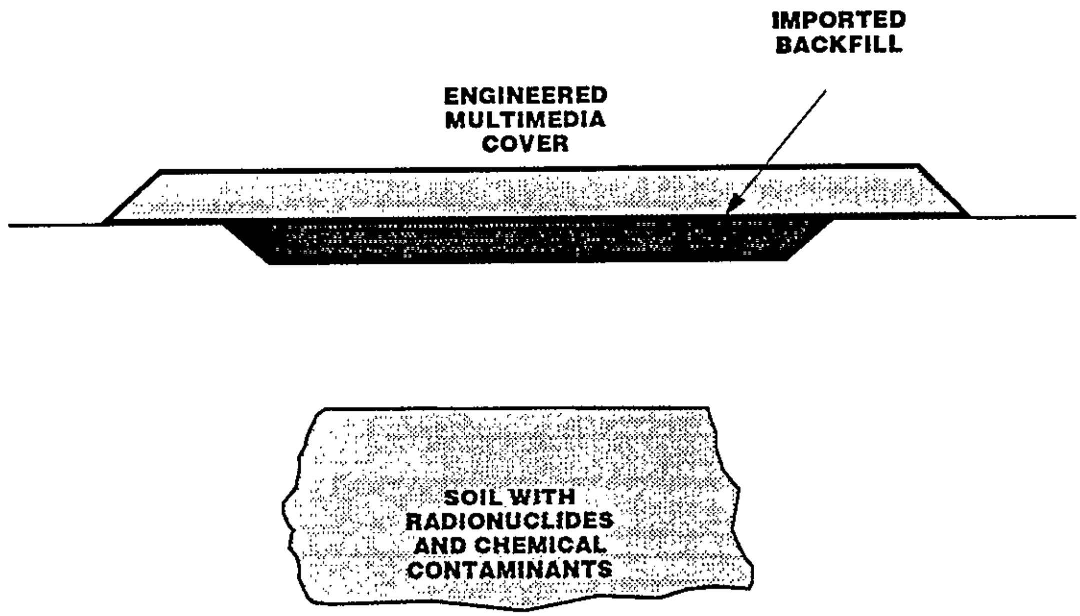

Figure 7-2. Alternative 1: Multimedia Cover.

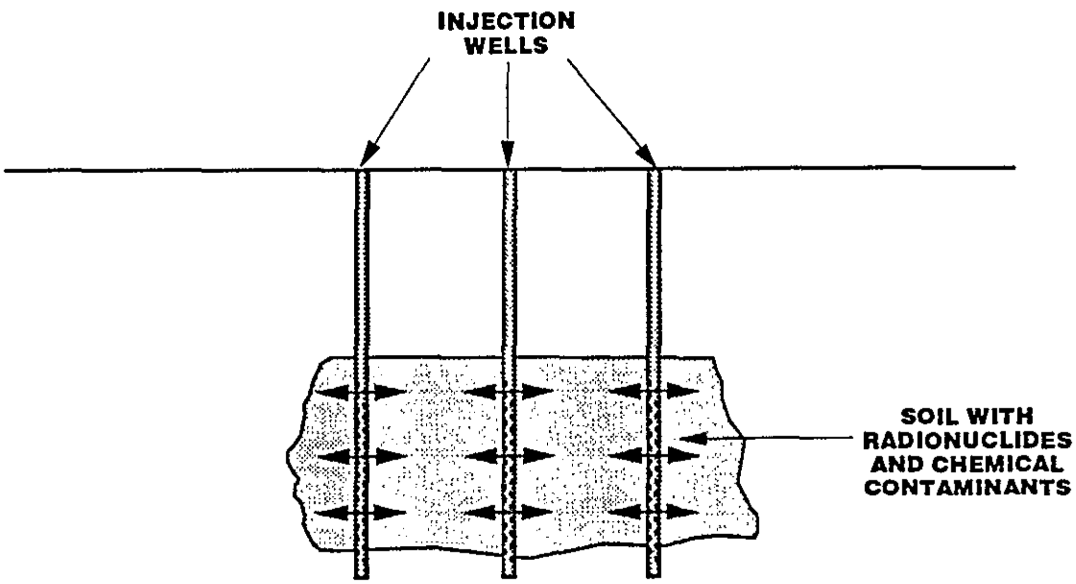

Figure 7-3. Alternative 2: In Situ Grouting of Soil.

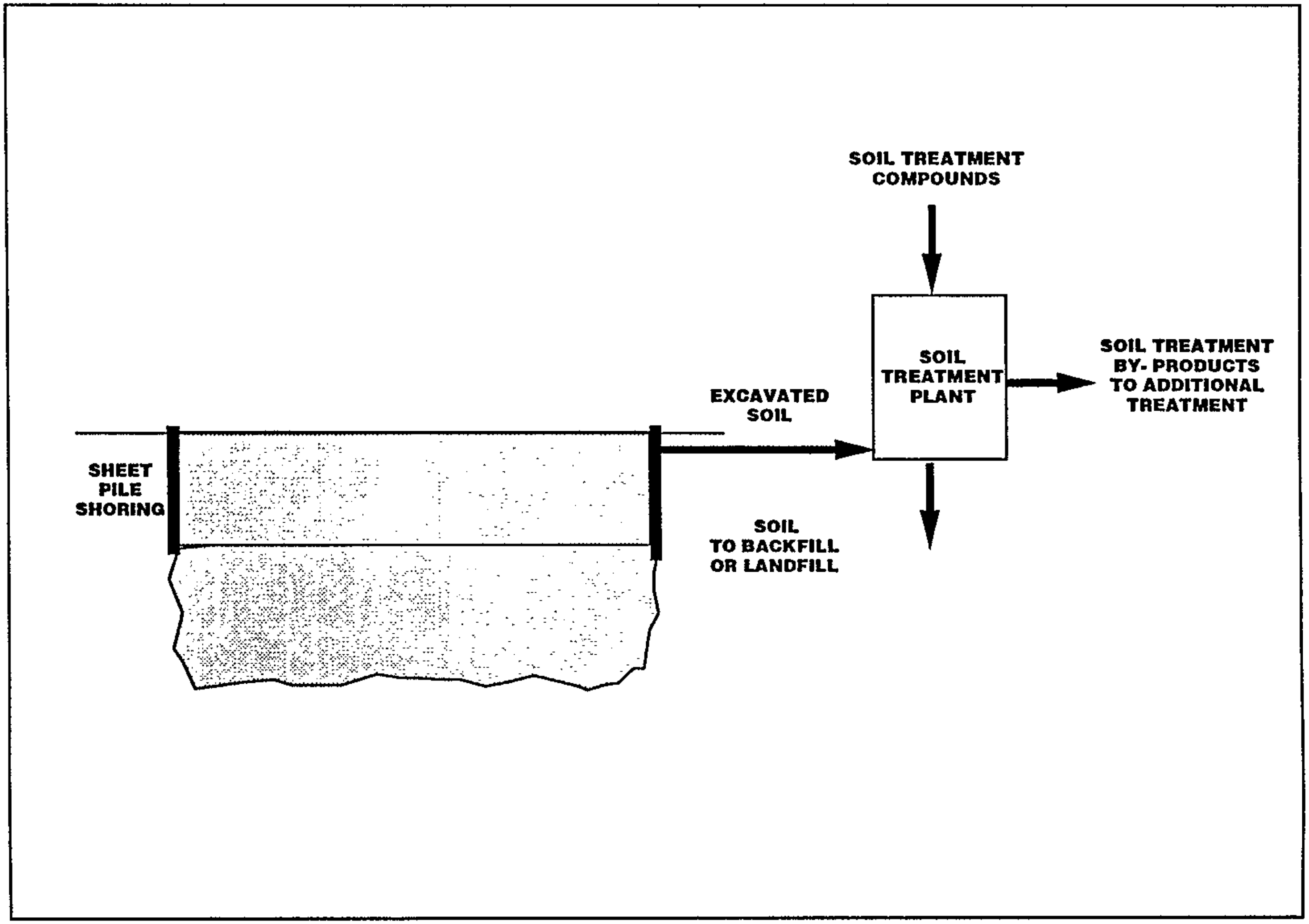

Figure 7-4. Alternative 3: Excavation, Treatment and Disposal.

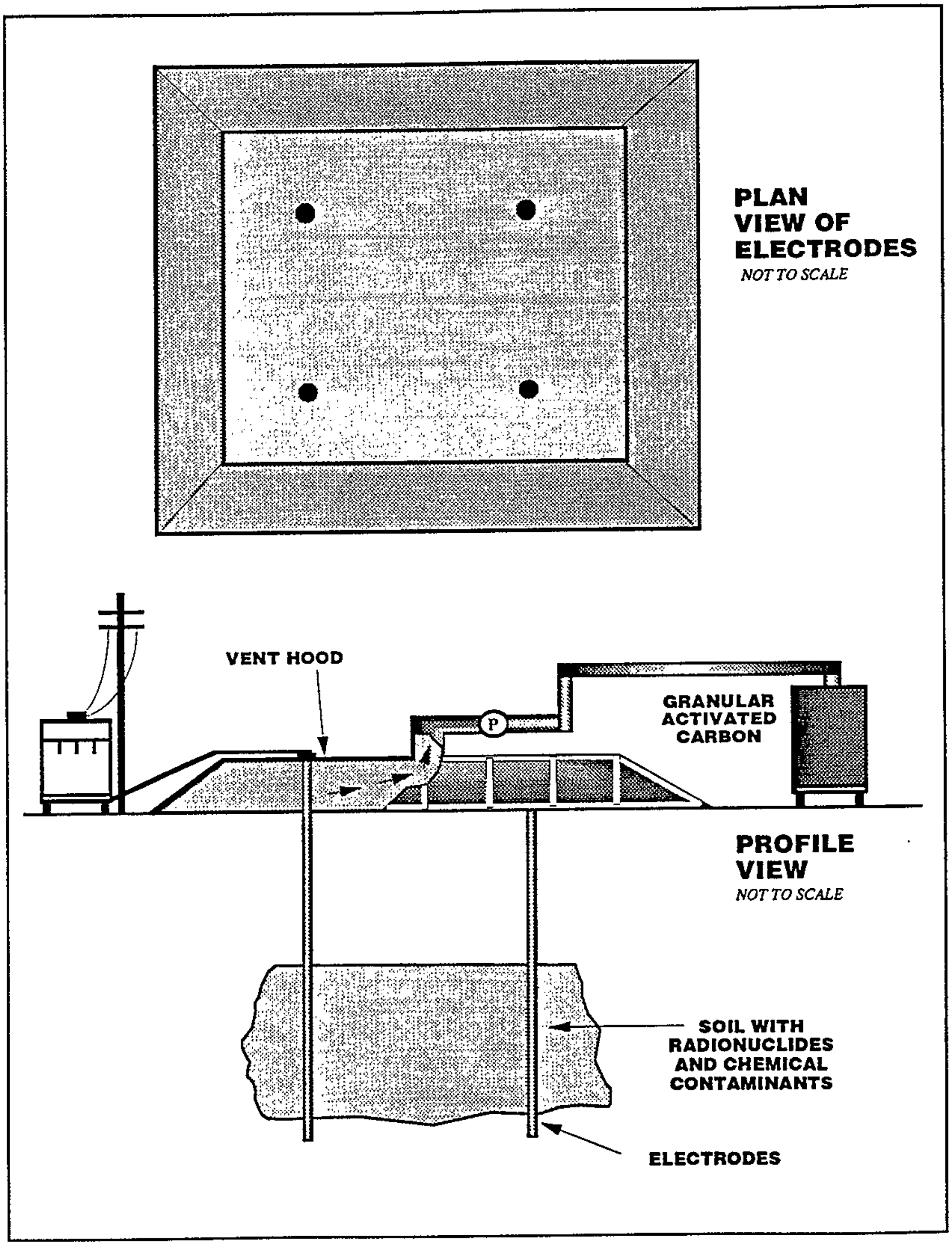

Figure 7-5. Alternative 4: In Situ Vitrification of Soil.

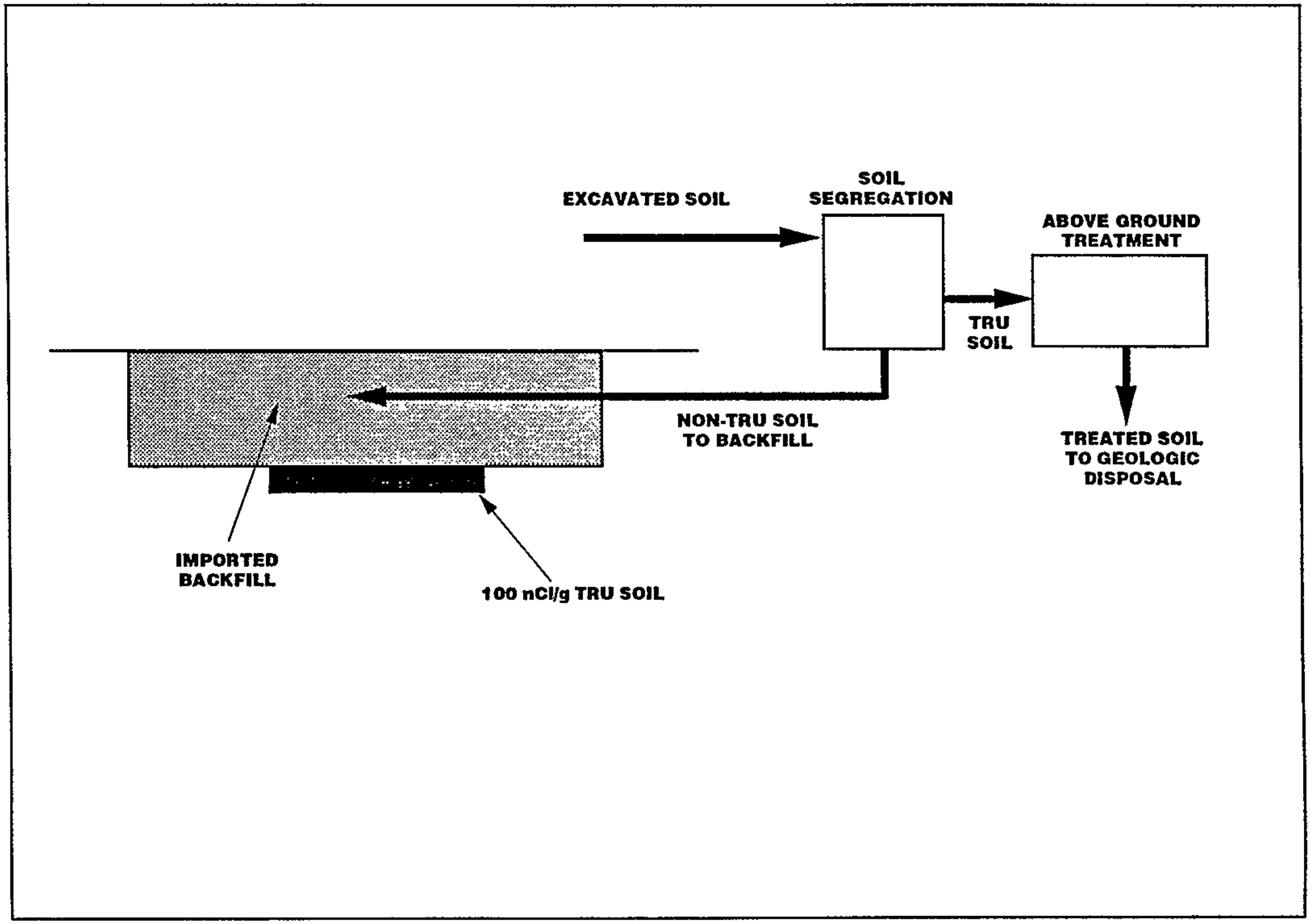

Figure 7-6. Alternative 5: Excavation, Vitrification, and Geologic Disposal of Soil with TRU Radionuclides.

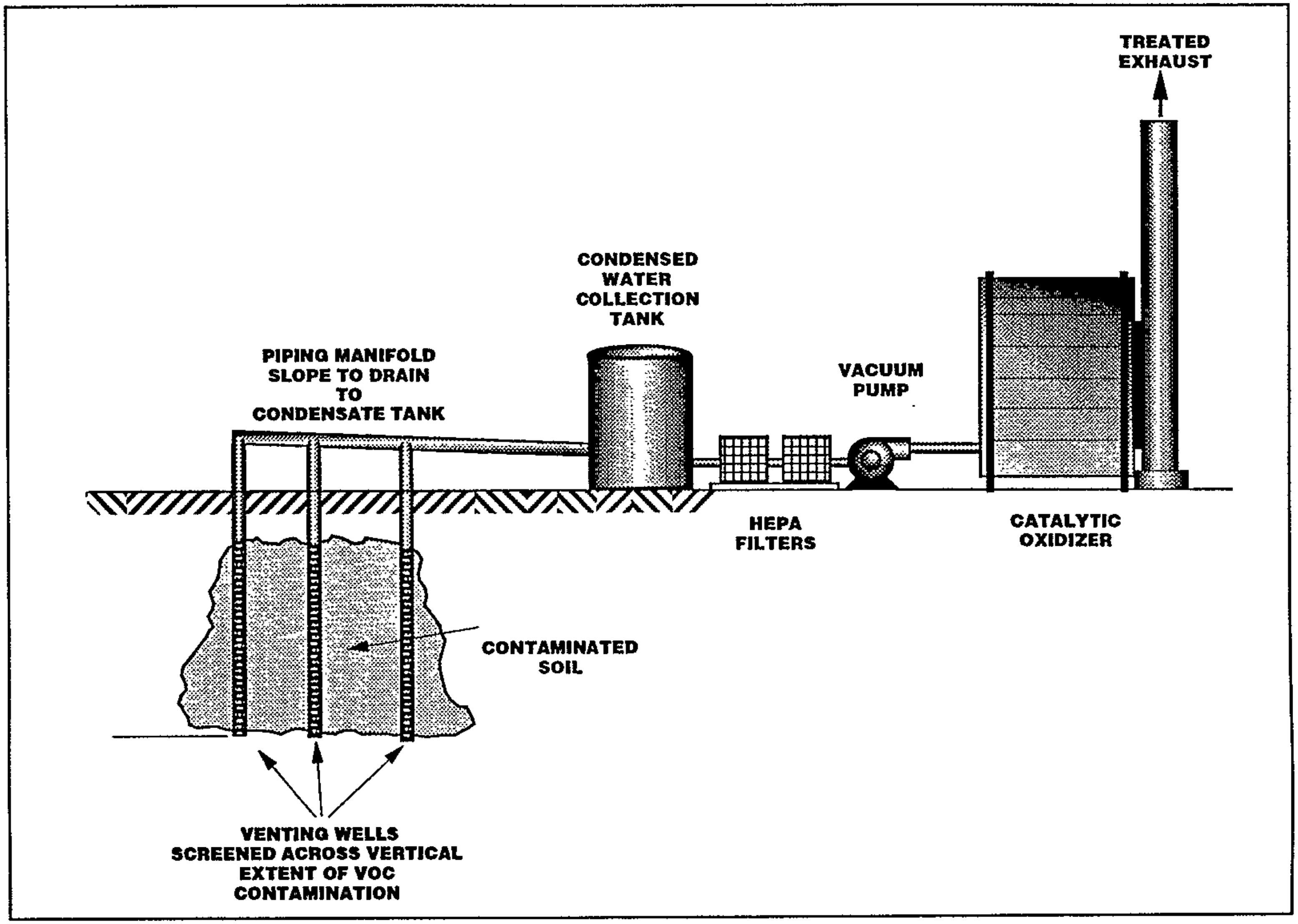

Figure 7-7. Alternative 6: Soil Vapor Extraction for Volatile Organic Compounds (VOCs).

Table 7-1. Preliminary Remedial Action Objectives and General Response Actions.

Environmental Media	Remedial Action Objectives: Human Health	Remedial Action Objectives: Environmental Protection	General Response Actions
Soils/ Sediments	• Prevent ingestion, inhalation, or direct contact with solids containing radioactive and/or hazardous constituents present at concentrations above MTCA and DOE standards for industrial sites (or subsequent risk-based standards). • Remediate soils containing TRU contamination above 100 nCi/g in accordance with 40 CFR 191 requirements. • Prevent leaching of contaminants from the soil into the groundwater that would cause groundwater concentrations to exceed MTCA and DOE standards at the compliance point location.	• Prevent migration of radionuclides and hazardous constituents that would result in groundwater, surface water, air, or biota contamination with constituents at concentrations exceeding ARARs.	• No Action • Institutional Controls • Containment • Excavation • Treatment • Disposal • In Situ Treatment
Biota	• Prevent bio uptake by plants. • Prevent disturbance of engineered barriers by biota.	• Prevent bio-uptake of radioactive contaminants.	• No Action • Institutional Controls • Excavation • Disposal • Containment
Air (1)	• Prevent inhalation of contaminated airborne particulates and/or volatile emissions exceeding MTCA and DOE limits from soils/sediments. • Prevent accidental release from collapse of containment structures.	• Prevent adverse environmental impacts on local biota.	

Note: (1) No General Response Actions are required for the air because soil remediation will eliminate the air contamination source.

Table 7-2. Preliminary Remedial Action Technologies.

Media	General Response Action	Technology Type	Process Option	Contaminants Treated
Soil	No Action	No Action	No Action	NA
	Institutional Controls	Land Use Restrictions	Deed Restrictions	NA
		Access Controls	Signs/Fences	NA
			Entry Control	NA
		Monitoring	Monitoring	NA
	Containment	Capping	Multimedia	I,M,R,O
		Vertical Barriers	Slurry Walls	I,M,R,O
			Grout Curtains	I,M,R,O
			Cryogenic Walls	I,M,R,O
		Dust & Vapor Suppression	Membranes/Sealants/ Wind Breaks/Wetting Agents	I,M,R,O
	Excavation	Excavation	Standard Construction Equipment	I,M,R,O
	Treatment	Thermal Treatment	Vitrification	I,M,R,O
			Incineration	O
			Thermal Desorption	O
			Calcination	I,M,R,O
		Chemical Treatment	Chemical Reduction	M
			Hydrolysis	I,O
		Physical Treatment	Soil Washing	I,M,R,O
			Solvent Extraction	O
			Physical Separation	I,M,R,O

Table 7-2. Preliminary Remedial Action Technologies.

Media	General Response Action	Technology Type	Process Option	Contaminants Treated
			Fixation/Solidification/ Stabilization	I,M,R,O
			Containerization	I,M,R,O
		Biological Treatment	Aerobic	O
			Anaerobic	O
	Disposal	Landfill Disposal	Landfill Disposal	I,M,R,O
		Geologic Repository	Geologic Repository	R (I,M,O if mixed with R)
	In Situ Treatment	Thermal Treatment	Vitrification	I,M,R,O
			Thermal Desorption	O
		Chemical Treatment	Reduction	M,O
		Physical Treatment	Soil Flushing	I,M,R,O
			Vapor Extraction	O
			Grouting	I,M,R
			Fixation/Solidification/ Stabilization	I,M,R,O
		Biological Treatment	Aerobic	O
			Anaerobic	O
Biota	No Action	No Action	No Action	NA
	Institutional Controls	Land Use Restrictions	Deed Restrictions	NA
		Access Controls	Signs/Fences	NA
			Entry Control	NA
		Monitoring	Monitoring	NA

Table 7-2. Preliminary Remedial Action Technologies.

Media	General Response Action	Technology Type	Process Option	Contaminants Treated
	Excavation	Excavation	Standard Construction Equipment	I,M,R,O
	Disposal	Landfill Disposal	Landfill Disposal	I,M,R,O
	Containment	Capping	Multimedia	I,M,R,O

I = Other Inorganics contaminants applicability
M = Heavy Metals contaminants applicability
R = Radionuclide contaminants applicability
O = Organic contaminants applicability
NA = Not Applicable

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
SOIL TECHNOLOGIES:						
No Action	No Action	Do nothing to cleanup the contamination or reduce the exposure pathways.	Not effective in reducing the contamination or exposure pathways.	Easily implemented, but might not be acceptable to regulatory agencies, local governments, and the public.	Low	Retained as a "baseline" case.
Land Use Restrictions	Deed Restrictions	Identify contaminated areas and prohibit certain land uses such as farming.	Depends on continued implementation. Does not reduce contamination.	Administrative decision is easily implemented.	Low	Retained to be used in conjunction with other process options.
Access Controls	Signs/Fences	Install a fence and signs around areas of soil contamination.	Effective if the fence and signs are maintained.	Easily implemented. Restrictions on future land use.	Low	Retained to be used in conjunction with other process options.
	Entry Control	Install a guard/monitoring system to prevent people from becoming exposed.	Very effective in keeping people out of the contaminated areas.	Equipment and personnel easily implemented and readily available.	Low	Retained to be used in conjunction with other process options.
Monitoring	Monitoring	Analyze soil and soil gas samples for contaminants and scan with radiation detectors.	Does not reduce the contamination, but is very effective in tracking the contaminant levels.	Easily implemented. Standard technology.	Low	Retained to be used in conjunction with other process options.
Capping	Multimedia	Fine soils over synthetic membrane or other layers and covered with soil; applied over contaminated areas.	Effective on all types of contaminants, not likely to crack. Likely to hold up over time.	Easily implemented. Restrictions on future land use will be necessary.	Medium	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
Vertical Barriers	Slurry Walls	Trench around areas of contamination is filled with a soil (or cement) bentonite slurry.	Effective in blocking lateral movement of all types of soil contamination. May not be effective for deep contamination.	Commonly used practice and easily implemented with standard earth moving equipment. May not be possible for deep contamination.	Medium	Retained for shallow contamination.
	Grout Curtains	Pressure injection of grout in a regular pattern of drilled holes.	Effective in blocking lateral movement of all types of soil contamination.	Commonly used practice and easily implementable, but depends on soil type. May be difficult to ensure continuous wall.	Medium	Retained because of potential effectiveness and implementability.
	Cryogenic Walls	Circulate refrigerant in pipes surrounding the contaminated site to create a frozen curtain with the pore water.	Effective in blocking lateral movement of all types of soil contamination.	Specialized engineering design required. Requires ongoing freezing.	Medium	Rejected because it is difficult to implement.
Dust and Vapor Suppression	Membranes/ Sealants/Wind Breaks/Wetting Agents	Using membranes, sealants, wind breaks, or wetting agents on top of the contaminated soil to keep the contaminants from becoming airborne.	Effective in blocking the airborne pathways of all the soil contaminants, but may require regular upkeep.	Commonly used practice and very easy to implement, but land restrictions will be necessary.	Low	Rejected because of limited duration of integrity and protection.
Excavation	Standard Excavating Equipment	Moving soil around the site and loading soil onto process system equipment.	Effective in moving and transporting soil to vehicles for transportation, and for grading the surface.	Equipment and workers are readily available.	Low	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
Thermal Treatment	Above-ground Vitrification	Convert soil to glassy materials by application of electric current.	Effective in destroying organics and immobilizing the inorganics and radionuclides. Off-gas treatment for volatiles may be required.	Commercial units are available. Laboratory testing required to determine additives, operating conditions, and off gas treatment. Must pre-treat soil to reduce size of large materials.	High	Retained because of potential ability to immobilize radionuclides and destroy organics.
	Incineration	Destroy organics by combustion in a fluidized bed, kiln, etc.	Effectively destroys the organic soil contaminants. Some heavy metals will volatilize. Radionuclides will not be treated.	Technology is well developed. Mobile units are currently available for relatively small soil quantities. Off-site treatment is available. Air emissions and wastewater generation should be addressed.	High	Rejected because of potential air emissions and wastewater generation.
	Thermal Desorption	Organic volatilization at 150 to 400°C (300 to 800°F) by heating contaminated soil followed by off gas treatment.	Effectively destroys the organic soil contaminants. Heavy metals less likely to volatilize than in high temperature treatments. Radionuclides will not be treated.	Successfully demonstrated on a pilot-scale level. Full-scale remediation yet to be demonstrated. Pilot testing essential.	Medium	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
	Calcination	High temperature decomposition of solids into separate solid and gaseous components without air contact.	Effective in the decomposition of inorganics such as hydroxides, carbonates, nitrates, sulfates, and sulfites. Removes organic components but does not combust them because of the absence of air. Radionuclides will not be treated.	Commercially available. Most often used for concentration and volume reduction of liquid or aqueous waste. Off-gas treatment is required.	High	Rejected because of limited effectiveness on non-liquid or aqueous wastes.
Chemical Treatment	Chemical Reduction	Treat soils with a reducing agent to convert contaminants to a more stable or less toxic form.	May be effective in treating heavy metal soil contaminants. Radioactivity will not be reduced.	Virtually untested on treating soils. Competing reactions may reduce efficiency.	Medium	Rejected because of limited applicability and implementation problems.
	Hydrolysis	Acid- or base-catalyst reaction in water to break down contaminants to less toxic components.	Very effective on compounds generally classified as reactive. Limited effectiveness on stable compounds. Radioactivity will not be reduced.	Common industrial process. Use for treatment of soils not well demonstrated.	Medium	Rejected because of limited effectiveness and unproven on soils.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
Physical Treatment	Soil Washing	Leaching of waste constituents from contaminated soil using a washing solution.	Effectiveness is contaminant specific. Generally more effective on contaminants that partition to the fine soil fraction. Radioactivity will not be reduced.	Treatability tests are necessary. Well developed technology and commercially available.	Medium	Retained because of potential effectiveness and implementability.
	Solvent Extraction	Contacting a solvent with contaminated soils to preferentially dissolve the contaminants into the solvent.	The selected solvent is often just as hazardous as the contaminants presented in the waste. May lead to further contamination. Radioactivity will not be reduced.	Laboratory testing necessary to determine appropriate solvent and operating conditions. Not fully demonstrated for hazardous waste applications.	Medium	Rejected because the solvent may lead to further contamination.
	Physical Separation	Separating soil into size fractions.	Effective as a concentration process for all contaminants that partition to a specific soil size fraction.	Most often used as a pretreatment to be combined with another technology. Equipment is readily available.	Low	Retained because of potential effectiveness and implementability.
	Fixation/ Solidification/ Stabilization	Form low permeability solid matrix by mixing soil with cement, asphalt, or polymeric materials.	Effective in reducing inorganic and radionuclide soil contaminant mobility. Effectiveness for organic stabilization is highly dependent on the binding agent.	Stabilization has been implemented for site remediations. Treatability studies are needed. Volume of waste is increased.	Medium	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
	Containerization	Enclosing a volume of waste within an inert jacket or container.	Effective for difficult to stabilize, extremely hazardous, or reactive waste. Reduces the mobility of radionculides.	May be implemented for low concentration waste. Disposal or safe storage of containers required. Regulatory constraints may prevent disposal of containers of certain waste types.	Low	Retained because of potential effectiveness and implementability.
Biological Treatment	Aerobic	Microbial degradation in an oxygen-rich environment.	Effectiveness is very contaminant- and concentration-specific. Treatment has been demonstrated on a variety of organic compounds. Not effective on inorganics or radionuclides.	Various options are commercially available to produce contaminant degradation. Treatability tests are required to determine site-specific conditions.	Medium	Rejected because of limited applicability and difficult implementation.
	Anaerobic	Microbial degradation in an oxygen deficient environment.	Effectiveness is very contaminant and concentration specific. Treatment has been demonstrated on a variety of organic compounds. Not effective on inorganics or radionuclides.	Various options are commercially available to produce contaminant degradation. Treatability tests are required to determine site-specific conditions.	Medium	Rejected because of limited applicability and difficult implementation.
Disposal	Landfill Disposal	Place contaminated soil in an existing onsite landfill.	Does not reduce the soil contamination but moves all of the contamination to a more secure place.	Easily implemented if sufficient storage is available in an on-site landfill area.	Medium	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
	Geologic Repository	Put the contaminated soil in a safe geologic repository.	Does not reduce the soil contamination, but is a very effective and long-term way of storing radionuclides. Probably unnecessary for nonradioactive waste.	Not easy to implement because of limited site availability, and permits for transporting radioactive wastes are hard to get.	High	Retained because of effectiveness on TRU wastes.
In Situ Thermal Treatment	Vitrification	Electrodes are inserted into the soil and a carbon/glass frit is placed between the electrodes to act as a starter path for initial melt to take place.	Effective in immobilizing radionuclides and most inorganics. Effectively destroys some organics through pyrolysis. Some volatilization of organics and inorganics may occur.	Potentially implementable. Implementability depends on site configuration, e.g., lateral and vertical extent of contamination. Treatability studies required.	High	Retained because of potential ability to immobilize radionuclides and destroy organics.
	Thermal Desorption	Soil is heated in situ by radio-frequency electrodes or other means of heating to temperatures in the 80 to 400°C (200 to 750°F) range thereby causing desorption of volatile and semi-volatile organics from the soil.	Effective for removal of volatile and semi-volatile organics from soil. Ineffective for most inorganics and radionuclides. Contaminants are transferred from soil to air.	Implementable for shallow organics contamination. Not implementable for radionuclides and inorganics. Emission treatment and treatability studies required.	Medium	Rejected because of limited applicability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
In Situ Chemical Treatment	Chemical Reduction	Reducing agent is added to the soil to change oxidation state of target contaminant.	Effective for certain inorganics, e.g., chromium. Ineffective for organics. Limited applicability.	Difficult to implement in situ because of distribution requirements for reducing agent.	Low	Rejected because of limited applicability and implementation problems.
In Situ Physical Treatment	Soil Flushing	Solutions are injected through injection system to flush and extract contaminants.	Potentially effective for all contaminants. Effectiveness depends on chemical additives and hydrology. Flushing solutions posing environmental threat likely to be needed. Difficult recovery of flushing solution.	Difficult to implement. Not implementable for complex solvents of contaminants. Flushing solution difficult to recover. Chemical additives likely to pose environmental threat.	Medium	Rejected because of implementation problem.
	Vapor Extraction	Vacuum is applied by use of wells inducing a pressure gradient that causes volatiles to flow through air spaces between soil particles to the extraction wells.	Effective for volatile organics. Ineffective for inorganics and radionuclides. Emission treatment required.	Easily implementable for proper site conditions. Requires emission treatment for organics and capture system for radionuclides and volatilized metals.	Medium	Retained for potential application to volatile organics.
	Grouting	Involves drilling and injection of grout to form barrier or injection to fill voids.	Effective in limiting migration of leachate, but difficult to maintain barrier integrity. Potentially effective in filling voids.	Implementable as barrier and for filling voids. Implementability depends on site conditions.	Medium	Retained because of ability to limit contaminant migration and potential use for filling void spaces.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
	Fixation/ Solidification/ Stabilization	Solidification agent is applied to soil by mixing in place.	Effective for inorganics and radionuclides. Potentially effective for organics. Effectiveness depends on site conditions and additives used.	Implementable. Treatability studies required to select proper additives. Thorough characterization of subsurface conditions and continuous monitoring required.	Medium	Retained because of potential effectiveness and implementability.
In Situ Biological Treatment	Aerobic	Microbial growth utilizing organic contaminants as substrate is enhanced by injection of or spraying with oxygen source and nutrients.	Effective for most organics at proper conditions. Ineffective for inorganics and radionuclides.	Difficult to implement. Treatability studies and thorough subsurface characterization required.	Low	Rejected because of limited applicability and difficult implementation.
	Anaerobic	Microbial growth utilizing organic contaminants as substrate is enhanced by addition of nutrients.	Effective for volatile and complex organics. Not effective for inorganics and radionuclides.	Difficult to implement. Anoxic ground conditions required. Treatability studies and thorough subsurface characterization necessary.	Low	Rejected because of limited applicability and difficult implementation.
BIOTA TECHNOLOGIES:						
No Action	No Action	Do nothing to clean-up the contamination or reduce the exposure pathways.	Not effective in reducing the contamination or exposure pathways.	Easily implemented, but might not be acceptable to regulatory agencies, local governments, and the public.	Low	Retained as a "baseline"case.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
Land Use Restrictions	Deed Restrictions	Identify contaminated areas and prohibit certain land uses such as agriculture.	Effective if implementation is continued. Does not reduce contamination.	Administrative decision is easily implemented.	Low	Retained to be used in conjunction with other process options.
Access Controls	Signs/Fences	Install a fence and signs around areas of contamination to keep people out and the biota in.	Effective if fencing is maintained.	Easily implemented. Restrictions on future land use.	Low	Retained to be used in conjunction with other process options.
	Entry Control	Install a guard/monitoring system to eliminate people from coming in contact with the contamination.	Very effective in keeping people out of the contaminated areas.	Equipment and personnel are easily implemented and readily available.	Low	Retained to be used in conjunction with other process options.
Monitoring	Monitoring	Take biota samples and test them for contaminants.	Does not reduce the contamination, but is very effective tracking the contaminant levels.	Easily implemented. Standard Technology.	Low	Retained to be used in conjunction with other process options.
Capping	Multimedia	Fine soils over synthetic membrane or other layers and covered with soil; applied over contaminated areas.	Effective in reducing the uptake of contaminants, not likely to crack. Likely to hold up over time.	Easily implemented. Restrictions on future land use will also be necessary.	Medium	Retained because of potential effectiveness and implementability.
Excavation	Standard Excavating Equipment	Remove affected biota and load it onto process system equipment.	Effective in moving and transporting biota to vehicles for transportation.	Equipment and workers are readily available.	Low	Retained because of potential effectiveness and implementability.

Table 7-3. Screening of Process Options.

Technology Type	Process Option	Description	Effectiveness	Implementability	Relative Cost	Conclusions
Disposal	Landfill Disposal	Place contaminated biota in an existing landfill.	Does not reduce the biota contamination but moves all of the contamination to a more secure place.	Easily implemented if sufficient storage is available in an offsite landfill area.	Medium	Retained because of potential effectiveness and implementability.

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
Tanks and Vaults						
241-B-361 Settling Tank	--	--	X	--	--	--
Cribs and Drains						
216-B-7A Crib	X	X	X	X	X	--
216-B-7B Crib	X	X	X	X	X	--
216-B-8TF Crib/Tile Field	X	X	X	X	X	--
216-B-9TF Crib/Tile Field	X	X	X	X	X	--
216-B-10A Crib	X	X	X	X	X	--
216-B-10B Crib	X	X	X	X	X	--
216-B-12 Crib	X	X	X	X	X	X
216-B-14 Crib	X	X	X	X	X	X
216-B-15 Crib	X	X	X	X	X	X
216-B-16 Crib	X	X	X	X	X	X
216-B-17 Crib	X	X	X	X	X	X
216-B-18 Crib	X	X	X	X	X	X
216-B-19 Crib	X	X	X	X	X	X
216-B-43 Crib	X	X	X	X	X	X
216-B-44 Crib	X	X	X	X	X	X
216-B-45 Crib	X	X	X	X	X	X
216-B-46 Crib	X	X	X	X	X	X

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
216-B-47 Crib	X	X	X	X	X	X
216-B-48 Crib	X	X	X	X	X	X
216-B-49 Crib	X	X	X	X	X	X
216-B-50 Crib	X	X	X	X	X	X
216-B-55 Crib[a/]	X	X	X	X	X	--
216-B-56 Crib	X	X	X	X	X	--
216-B-57 Crib	X	X	X	X	X	--
216-B-60 Crib	X	X	X	X	X	--
216-B-61 Crib[b/]	--	--	--	--	--	--
216-B-62 Crib[a/]	X	X	X	X	X	--
CTF North of 2703-E	X	X	X	X	X	--
216-B-13 French Drain	X	X	X	X	X	--
216-B-51 French Drain	X	X	X	X	X	--
Reverse Wells						
216-B-4 Reverse Well	X	X	--	--	--	--
216-B-5 Reverse Well	X	X	--	--	--	--
216-B-6 Reverse Well	X	X	--	--	--	--
216-B-11A Reverse Well	X	X	--	--	--	--
216-B-11B Reverse Well	X	X	--	--	--	--

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
Ponds, Ditches, and Trenches						
216-B-3 Pond[a/]	X	X	X	--	--	--
216-B-3A Pond[a/]	X	X	X	--	--	--
216-B-3B Pond[a/]	X	X	X	--	--	--
216-B-3C Pond[a/]	X	X	X	--	--	--
216-A-25 Pond	X	X	X	--	--	--
216-E-28 Contingency Pond[a/]				--	--	--
216-N-8 Pond	X	X	X	--	X	X
216-B-2-1 Ditch	X	X	X	X	X	--
216-B-2-2 Ditch	X	X	X	X	X	--
216-B-2-3 Ditch	X	X	X	X	X	--
216-B-3-1 Ditch	X	X	X	X	X	X
216-B-3-2 Ditch	X	X	X	X	X	X
216-B-3-3 Ditch[a/]	X	X	X	X	X	X
216-B-20 Trench	X	X	X	X	X	X
216-B-21 Trench	X	X	X	X	X	X
216-B-22 Trench	X	X	X	X	X	X
216-B-23 Trench	X	X	X	X	X	X
216-B-24 Trench	X	X	X	X	X	X
216-B-25 Trench	X	X	X	X	X	X

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
216-B-26 Trench	X	X	X	X	X	X
216-B-27 Trench	X	X	X	X	X	X
216-B-28 Trench	X	X	X	X	X	X
216-B-29 Trench	X	X	X	X	X	X
216-B-30 Trench	X	X	X	X	X	X
216-B-31 Trench	X	X	X	X	X	X
216-B-32 Trench	X	X	X	X	X	X
216-B-33 Trench	X	X	X	X	X	X
216-B-34 Trench	X	X	X	X	X	X
216-B-35 Trench	X	X	X	X	X	--
216-B-36 Trench	X	X	X	X	X	--
216-B-37 Trench	X	X	X	X	X	--
216-B-38 Trench	X	X	X	X	X	--
216-B-39 Trench	X	X	X	X	X	--
216-B-40 Trench	X	X	X	X	X	--
216-B-41 Trench	X	X	X	X	X	--
216-B-42 Trench	X	X	X	X	X	--
216-B-52 Trench	X	X	X	X	X	X
216-B-53A Trench	X	X	X	X	X	--
216-B-53B Trench	X	X	X	X	X	--

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
216-B-54 Trench	X	X	X	X	X	--
216-B-58 Trench	X	X	X	X	X	--
216-B-63 Trench[a/]	X	X	X	X	X	--
Septic Tanks and Associated Drain Fields						
2607-E1 Septic Tank[a/ b/]	X	X	X	--	--	--
2607-E2 Septic Tank[a/ b/]	X	X	X	--	--	--
2607-E3 Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-E4 Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-E7B Septic Tank[a/ b/]	X	X	X	--	--	--
2607-E8 Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-E9 Septic Tank[a/ b/]	X	X	X	--	--	--
2607-E11 Septic Tank[a/ b/]	X	X	X	--	--	--
2607-EB Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-EH Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-EK Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-EM Septic Tank[a/ b/]	X	X	X	--	--	--
2607-EN Septic Tank[a/ b/]	X	X	X	--	--	--
2607-EO Septic Tank[a/ b/]	X	X	X	--	--	--
2607-EP Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
2607-EQ Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
2607-ER Septic Tank[a/ b/]	X	X	X	--	--	--
2607-GF Septic Tank/Drain Field[a/ b/]	X	X	X	--	--	--
Retention Basins						
207-B Retention Basin[a/]	X	X	X	X	X	--
216-B-59B Retention Basin[a/]	X	X	X	X	X	--
216-B-64 Retention Basin	X	X	X	X	X	--
Burial Sites						
218-E-2 Burial Ground	X	X	X	--	--	--
218-E-2A Burial Ground[b/]	--	--	--	--	--	--
218-E-3 Burial Ground[b/]	--	--	--	--	--	--
218-E-4 Burial Ground	X	X	X	--	--	--
218-E-5 Burial Ground	X	X	X	--	--	--
218-E-5A Burial Ground	X	X	X	--	--	--
218-E-6 Burial Ground[b/]	--	--	--	--	--	--
218-E-7 Burial Ground	X	X	X	--	--	--
218-E-9 Burial Ground	X	X	X	--	--	--
200 Area Construction Pit[b/]	--	--	--	--	--	--

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
Unplanned Releases						
UN-200-E-7	X	X	X	X	--	--
UN-200-E-9	X	X	X	X	--	--
UN-200-E-14[c/]	--	--	--	--	--	--
UN-200-E-41[d/]	--	--	--	--	--	--
UN-200-E-43	X	--	X	--	--	--
UN-200-E-44	X	X	X	X	--	--
UN-200-E-52	X	--	X	--	--	--
UN-200-E-54	X	--	X	--	--	--
UN-200-E-55[c/]	--	--	--	--	--	--
UN-200-E-61[c/]	--	--	--	--	--	--
UN-200-E-63	X	--	X	--	--	--
UN-200-E-64	X	--	X	--	--	--
UN-200-E-69	--	--	X	--	--	--
UN-200-E-79	X	X	X	X	--	--
UN-200-E-80	X	X	X	X	X	--
UN-200-E-83	--	--	X	--	--	--
UN-200-E-87	X	X	X	X		
UN-200-E-90	--	--	X	--	--	--
UN-200-E-92[c/]	--	--	--	--	--	--

Table 7-4. Preliminary Remedial Action Alternatives Applicable to Waste Management Units and Unplanned Release Sites.

Waste Management Unit or Unplanned Release	Alt. 1 Multimedia Cover With or Without Vertical Barriers	Alt. 2 In Situ Grouting	Alt. 3 Excavation and Treatment	Alt. 4 In Situ Vitrification	Alt. 5 Excavation, Treatment, and Geologic Disp of TRU Soil	Alt. 6 In Situ Soil Vapor Extraction for VOC's
UN-200-E-95	X	--	X	--	--	--
UN-200-E-101	X	--	X	--	--	--
UN-200-E-103	X	X	X	X	--	--
UN-200-E-112[c/]	--	--	--	--	--	--
UN-200-E-140	X	X	X	X	--	X
UPR-200-E-4	X	X	X	--	--	--
UPR-200-E-32	X	X	X	X	--	--
UPR-200-E-34	X	X	X	--	--	--
UPR-200-E-51	X	X	X	--	--	--
UPR-200-E-84	X	X	X	X	--	--
UPR-200-E-138	X	X	X	X	--	--

a/ Active unit.
b/ No record of hazardous and/or radioactive use; no applicable alternative was identified.
c/ Records indicate that all environment contamination was been removed and disposed; no applicable alternative was identified.
d/ Non-soil contamination occurred; an alternative other than listed will be employed.

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8.0 DATA QUALITY OBJECTIVES

As described in Section 1.2.2, this aggregate area management study (AAMS) process, as part of the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a), is designed to focus the remedial investigation (RI)/feasibility study (FS) process toward comprehensive cleanup or closure of all contaminated areas at the earliest possible date and in the most effective manner. The fundamental principle of the *Hanford Site Past-Practice Strategy* is a "bias for action" which emphasizes the maximum use of existing data to expedite the RI/FS process as well as allow decisions about work that can be done at the site early in the process, such as expedited response actions (ERAs), interim remedial measures (IRMs), limited field investigations (LFIs), and focused feasibility studies (FFS). The data have already been described in previous sections (2.0, 3.0, and 4.0). Remediation alternatives are described in Section 7.0. However, data, whether existing or newly acquired, can only be used for these purposes if it meets the requirements of data quality as defined by the data quality objective (DQO) process developed by the U.S. Environmental Protection Agency (EPA) for use at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (EPA 1987). This section implements the DQO process for this, the scoping phase in the B-Plant Aggregate Area.

In the guidance document for DQO development (EPA 1987), the process is described as involving three stages which have been used in the organization of the following sections:

- Stage 1--Identify decision types (Section 8.1)
- Stage 2--Identify data uses and needs (Section 8.2)
- Stage 3--Design a data collection program (Section 8.3).

8.1 DECISION TYPES (STAGE 1)

Stage 1 of the DQO process is undertaken to identify:

- The decision makers (thus data users) relying on the data to be developed (Section 8.1.1),
- The data available to make these decisions (Section 8.1.2),
- The quality of these available data (Section 8.1.3),

- The conceptual model into which these data must be incorporated (Section 8.1.4), and

- The objectives and decisions that must evolve from the data (Section 8.1.5).

These issues serve to define, from various sides, the types of decisions that will be made on the basis of the B Plant AAMS.

8.1.1 Data Users

The data users for the B Plant AAMS [and subsequent investigations such as LFIs, RI/FSs, and Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFI)] are the following:

- The decision makers for policies and strategies on remedial action at the Hanford Site. These are the signatories of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1990) including the U.S. Department of Energy (DOE), EPA, and the Washington State Department of Ecology (Ecology).

Nominally these responsibilities are assigned to the heads of these agencies (the Secretary of Energy for DOE, the Administrator of EPA, and the Director of Ecology), although the political process requires that more local policy-makers (such as the Regional Administrator of EPA and the head of the U.S. Department of Energy, Richland Operations Office [DOE/RL]) and, to a great extent, technical and policy-assessment staff of these agencies will have a major say in the decisions to be evolved through this process.

- Unit managers of Westinghouse Hanford and potentially other Hanford Site contractors who will be tasked with implementing remedial activities at the B Plant Aggregate Area. Staff of these contractors will have to make the lower level (tactical) decisions about appropriate scheduling of activities and allocation of resources (funding, personnel, and equipment) to accomplish the recommendations of the AAMS.

- Concerned members of the wide community involved with the Hanford Site. These may include:

  - Other state (Washington, Oregon, and other states) and federal agencies,
  - Affected Indian tribes,

- Special interest groups, and
- The general public.

These groups will be involved in the decision process through the implementation of the Community Relations Plan (CRP) (Ecology et al. 1989), and will apply their concerns through the "primary" data users, the signatories of the Tri-Party Agreement.

The needs of these users will have a pivotal role in issues of data quality. Some of this influence is already imposed by the guidance of the Tri-Party Agreement.

8.1.2 Available Information

The *Hanford Site Past-Practice Strategy* specifies a "bias for action" that intends to make the maximal use of existing data on an initial basis for decisions about remediation. This emphasis can only be implemented if the existing data are adequate for the purpose.

Available data for the B Plant Aggregate Area are presented in Sections 2.0, 3.0, and 4.0 and in Topical Reports prepared for this study. As described in Section 1.2.2, these data should address several issues:

- Issue 1: Facility and process descriptions and operational histories for waste sources (Sections 2.2, 2.3, and 2.4)
- Issue 2: Waste disposal records defining dates of disposal, waste types and waste quantities (Section 2.4)
- Issue 3: Sampling events of waste effluents and affected media (Section 4.1)
- Issue 4: Site conditions including the site physiography, topography, geology, hydrology, meteorology, ecology, demography, and archaeology (Section 3.0)
- Issue 5: Environmental monitoring data for affected media including air, surface water, sediment, soil, groundwater and biota (Section 4.1, except that groundwater data is presented in the separate 200 East Groundwater Aggregate Area Management Study Report, AAMSR).

A major requirement for adequate characterization of many of these issues is identification of chemical and radiological constituents associated with the sites, with a view to determine the contaminants of concern there and the extent of their distribution in the soils beneath each of the waste management units. There was found to be a limited amount of data in this regard. The data reported for the various waste management units in the B Plant Aggregate Area (see Section 4.1 and Tables 4-1, 4-2, and 4-3) have been found to describe:

- Inventory--generally estimated from chemical process data and emphasizing radionuclides (Issues 1 and 2). These data are especially limited regarding reconstruction of early activities, and even the most recent data are based on very few sampling events, possibly non-representative of the long-term activity of the waste management units.

- Surface radiological surveys--undifferentiated radiation levels, without identification of radionuclides present, presented in terms of extent of radiation and maximal levels (Issue 5). These historical data are extremely difficult to relate to the present-day distribution and nature of the radioactive contamination they purport to measure because of the lack of radionuclide identification and the likelihood that changes have occurred (at least to surface soils) since the time of the surveys.

- External radiation monitoring--similar to the surface radiological surveys but provide even less information because with a fixed-point thermoluminescent dosimeter (TLD) no spatial distribution is provided. In addition, data are also available for some TLDs placed at points not associated with specific waste management units. The TLD data do not differentiate radionuclide species.

- Waste, soil, or sediment sampling--these include sediment sampling in basins, ponds and ditche (ponds 216-B-3, 216-B-3A, 216-B-3C, 216-N-8, and 2101-M and ditch 216-B-3-3). The quality of these data will be addressed based on the criteria presented in Section 8.3. Changes at the release sites since the time of the sampling may make the data inapplicable to determination of the present-day distribution of contamination (Issue 5). Such changes might include cleanup activities which could alter the location of waste or cause soil particle fractionation, chemical leaching of contaminants, or contaminant reactions in the environment which could alter the nature of the contamination.

There are also some sets of data of soil sampling and analysis that were conducted for several years on a grid pattern, so cannot be assigned to a particular waste management unit. These data would indicate impacts of historical operations at the Hanford Site, and in the vicinity of the grid points, but the impacts cannot be ascribed to a particular unit and so do not assist in decision making on a unit-by-unit basis.

- Biota sampling--in the 216-B-3, 216-B-3C, and 216-N-8 Ponds as well as the 216-B-3-3 Ditch and 216-B-63 Trench. These data could assist assessment of bio-uptake and bio-transfer pathways from this unit (Issue 5).

- Borehole geophysics--these data, for a number of units which discharged to the soil column (cribs, french drains, reverse wells, ponds, trenches, and ditches) and the single-shell tanks, were designed to detect the presence of radionuclides (by their gamma-ray radiation) in the subsurface and to indicate whether these materials are migrating vertically (Issue 5). A list of these surveys that have been conducted in the B Plant Aggregate Area is included in the *B Plant Geologic and Geophysics Data Package for the 200 Aggregate Area Management Study* prepared for this study (Chamness et al. 1992). These data are limited by the method's inability to identify specific radionuclides and, thus, to differentiate naturally occurring radioactive materials from possible releases. Variations in quality control further limit their comparability and possible use for estimation of concentrations.

  Besides these historic data, additional borehole geophysical data will become available through the Radionuclide Logging System (RLS). Like the previous (gross gamma) logging conducted at waste management units in the B Plant Aggregate Area, the RLS depends on gamma rays and so cannot detect some species of radionuclides. However, unlike the gross gamma surveys, the RLS is designed to identify individual radionuclide species through their characteristic gamma ray photon energy levels. It should thus be able to differentiate naturally-occurring radionuclides from those resulting from releases. It will also (like gross gamma logging) determine the vertical extent of the presence of the radionuclides. It will be conducted in about ten wells located in the B Plant Aggregate Area. The RLS work has been planned, but has not yet begun.

  Note: A remedial investigation work plan for the 200-BP-1 Operable Unit is complete. Borehole geophysics data collection has begun but findings have not yet been published.

Based on the above summary, the data are considered to be of varying quality. These data have not been validated, a process generally required for risk assessment or final Record of Decision (ROD) purposes. Most of the data are based on field methods, which are generally applicable only for screening purposes and can be used to focus future activities (e.g., sampling and analysis plans).

These data are considered to be deficient in one or more of the following ways:

- The methods are unable to differentiate the various radionuclides that may have been present at the time of the survey.

- The release locations have been changed (especially by remediation activities) since the time of the survey or sampling, and it is likely that contaminant distributions have changed.

- The survey or sampling has been done at a location different from the waste management unit or release, and so would not be representative of the concentrations in the zone of release. This deficiency applies to horizontal and vertical differences in location: the borehole geophysics data may be at the correct depths, but the distance of the borehole from the waste management unit can severely attenuate the gamma-radiation that is used to indicate contamination; surface sampling and surveys similarly cannot establish subsurface contaminant concentrations or even disprove the possible presence of some radioactive constituents (particularly alpha-emitting transuranic, TRU, elements).

- There has been virtually no measurement of non-radioactive hazardous constituents in the sampling and analysis of media in the B Plant Aggregate Area. One exception to this is the remedial investigation activities recently begun in the 200-BP-1 Operable Unit.

As a result of these deficiencies, the data are not considered to be usable for input to a quantitative risk assessment or for comparison to applicable or relevant and appropriate requirements (ARARs).

In addition to these data, there are also data regarding site conditions (Issue 2) which do not directly relate to the presence of environmental releases but which will assist in the assessment of its potential migration if present. These data are generally summarized in the Topical Reports prepared for this AAMSR. Those include the following:

- *B Plant Geologic and Geophysics Data Package for the 200 AAMS* (Chamness et al. 1992), contains tables of wells in which borehole geophysics have been conducted, the types and dates of the tests, and a reference to indicate the physical location of the logs. The package also includes a list of the data available from the drilling of each well located in the B Plant Aggregate Area, such as the logs available (driller's or geologist's; indication of their physical location; grain size, carbonate, moisture, and chemical/radiological analyses; lists of depths, dates, elevation, and coordinates for all wells; and copies of the boring logs and well completion (as-built) summaries for a selection of wells in the B Plant Aggregate Area.

- *Geologic Setting of the 200 East Area: An Update* (Lindsey et al. 1992) includes descriptions of regional stratigraphy, structural geology, and local (200 East Area) stratigraphy, with revised structure and isopach maps of the various unconsolidated strata found beneath the 200 East Area.

The data in these topical reports was obtained for the AAMS study based on a review of driller's and geologist's logs for wells drilled in the B Plant Aggregate Area. A selection of 15 of those logs was made which best represented the geologic structures below the aggregate area and are presented in Chamness et al. (1992). Lindsey et al. (1992) then used these wells (and others from other aggregate areas in the 200 East Area) to develop cross-sections, structure maps, and isopach maps, which were in turn adapted to the specific needs of this report and presented in Section 3. Only existing logs were used; no new wells were drilled as part of this study. The quality of the data varies among the logs according to the time they were drilled and the scope of the study they were supporting, but the data are sufficient for the general geological characterization of the site. Issues involving the potential of contaminant migration at specific sites, based on stratigraphic concerns, may not be fully addressed through any existing borings or wells because appropriate borings may not be located in close proximity; these issues should be addressed during subsequent field investigations at locations where contaminant migration is considered likely.

Another class of data which was gathered in the general area of the 200 West Area, and thus potentially appropriate to the B Plant Aggregate Area, is the result of a set of studies which were performed for the Basalt Waste Isolation Project (BWIP) (DOE 1988), in the attempt to site a high-level radioactive waste geologic repository in the basalt beneath and in the vicinity of the Hanford Site. The proposed Reference Repository Site included the 200 West Area and some distance beyond it, mainly to the west. For this siting project, a number of geologic techniques were used, and some of the data generated by the drilling program has been used for the stratigraphic interpretation presented in Section 3.4 (all the wells denoted with an alias "BH-.." were drilled for the BWIP project) and a number of the figures used in this and other sections of Section 3.0. The program also included a number of geophysical studies, using the following techniques:

- Gravity
- Magnetics
- Seismic reflection
- Seismic refraction
- Magnetotellurics.

These data, as presented in Section 1.3.2.2.3 of DOE (1988), were reviewed for their relevance to the present B Plant (source area) Aggregate Area Management Study. The limitations of these studies include the following aspects:

- Most of the studies covered a regional scale with lines or coverages that may have crossed the B Plant Aggregate Area (or even the 200 East Area) only in passing. Some of the surveys (e.g., the grid of gravity stations) specifically avoided the 200 East Area ("due to restricted access").

- Many of the techniques are more sensitive to the basalt than to the suprabasalt sediments of specific interest in the AAMS program, and even less sensitive to the features which are closer to the surface, as is applicable to the source area AAMS. Basalt is by nature much denser than the unconsolidated sediments (and thus also has a characteristic seismic signature) and has more consistent magnetic properties. In addition, the analysis of the data emphasized the basalt features which were apparent in the data. All this is appropriate to a study of the basalt, but does not make the studies applicable to the present study.

- Even when features potentially caused by shallow sediments are identified, they are interpreted either very generally (e.g., "erosional features in the Hanford and (or) Ringold Formations") or as complications (e.g., "shallow sediment velocity variations causing stacking velocity correction errors"). There are only a very few features (and none in the B Plant Aggregate Area) which are interpreted as descriptive of the structure of the suprabasalt sediments.

- Lastly, some of the anomalies which are interpreted in terms of a sedimentary stratigraphic cause (e.g., "erosion of Middle Ringold") do not bear up under the more detailed stratigraphic interpretation carried out under the Topical Reports for the AAMS (Lindsey et al. 1992, Chamness et al. 1992).

However, these data will be reviewed in more detail for the purposes of the 200 East Groundwater AAMSR, since deeper features (including in the basalt) are of more concern for that study.

Other data presented in Sections 2.0, 3.0, and 4.0 are broad-scale rather than site-specific, as are the contaminant concentrations. These include topography, meteorology, surface hydrology, environmental resources, human resources, and contaminant characteristics. These data are generally of acceptable quality for the purposes of planning remedial actions in the B Plant Aggregate Area.

8.1.3 Evaluation of Available Data

The EPA (1987) has specified indicators of data quality, the five "PARCC" parameters (precision, accuracy, representativeness, completeness, and comparability), which can be used to evaluate the existing data and to specify requirements for future data collection.

- Precision--the reproducibility of the data

- Accuracy--the lack of a bias in the data.

  Much of the existing data are of limited precision and accuracy due to the analytical methods which have been used historically. The gross gamma borehole geophysical logging in particular is limited by methodological problems although reproducibility has been generally observed in the data. Conditions that have contributed to lack of precision and/or accuracy include: improvements in analytical instrumentation and methodology making older data incompatible; effects of background levels (particularly regarding radioactivity and inorganics); and lack of quality control on data acquisition.

  The limitations in precision and accuracy in existing data are mainly due to the progress of analytical methodologies and quality assurance (QA) procedures since the time they were collected. The *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) recommends that existing data be used to the maximum extent possible, at two levels: first to formulate the conceptual model, conduct a qualitative risk assessment, and prepare work plans, but also as an initial data set which can be the basis for a fully-qualified data set through a process of review, evaluation, and confirmation.

- Representativeness--the degree to which the appropriate environmental parameters or media have been sampled.

  This parameter highlights a shortcoming of most of the historical data. Limitations include the observation only of gross gamma radiation rather than differentiating it by radionuclide (e.g., through spectral surveying methods as are being used by the RLS program), the analysis of samples only for radionuclides rather than for chemicals and radionuclides, and the failure to sample (especially in the subsurface) for the full potential extent of contaminant migration.

  The data are incomplete primarily because of the lack of subsurface sampling for extent of contamination. Subsurface investigation activities have recently begun with the commencement of remedial investigation work in the 200-BP-1 Operable

Unit but data has not yet been published. The lack of these data is also caused by concerns to limit the potential exposure to radioactivity of workers who would have to drill in contaminated areas and the possible release or spread of contamination through these intrusive procedures. The result of this data gap is that none of the sites can be demonstrated to have contamination either above or below levels of regulatory concern, and a full quantitative risk assessment cannot be conducted.

In addition, in many cases it has been necessary to use general data (i.e., from elsewhere in the 200 East Area or even from the vicinity of the 200 Areas) rather than data specific to a particular waste management unit. For most purposes of characterization for transport mechanisms, this procedure is acceptable given the screening level of the present study. For example, while it is appropriate to use a limited number of boring logs to characterize the stratigraphy in the Aggregate Area (Chamness et al. 1992, Lindsey et al. 1992), the later, waste management unit specific, field sampling plans will require detailed consideration of more of the logs of boreholes drilled in the immediate vicinity, whatever their quality, as a starting point to conceptually model the geology specifically beneath that unit.

- Completeness--the fraction of samples which are considered "valid."

None of the data that have been previously gathered in the B Plant Aggregate Area has been "validated" in the EPA Contract Laboratory Program (CLP) sense with the exception of the remedial investigation work recently begun in the 200-BP-1 Operable Unit), although varying levels of quality control have been applied to the sampling and analysis procedures. The best indication of the validity of the data is the reproducibility of the results, and this indicates that validity (completeness) is one of the less significant problems with the data.

- Comparability -- the confidence that can be placed in the comparison to two data sets (e.g., separate samplings).

With varying levels of quality control and varying procedures for sample acquisition and analysis, this parameter is also generally poorly met. Much of this is due to the more recent development of QA procedures.

While these limitations cannot in most cases be quantified (and some such as representativeness are specifically only qualitative), most of the data gathered in the B Plant Aggregate Area can be cited as failing one or more of the PARCC parameters. These data should, however, be used to the maximum extent in the development of work plans for site field investigations, prioritization of the various units, and to determine, to the extent possible, where contamination is or is not present.

In addition to these site-specific data, there are also a limited number of non site-specific sampling events that are being developed to determine background levels of naturally occurring constituents (Hoover and LeGore 1991). These data can be used to differentiate the effect of the environmental releases from naturally occurring background levels.

8.1.4 Conceptual Model

The initial conceptual model of the waste management units in the B Plant Aggregate Area is presented and described in Section 4.2 (Figure 4-3). The model is based on best estimates of where contaminants were discharged and their potential for migration from release points. The conceptual model is designed to be conservatively inclusive in the face of a lack of data. This means that a migration pathway was included if there is any possibility of contamination travelling on it, historically or at present. In most cases there may not be a significant flux of such contamination migration for many of the pathways shown on the figure.

The pathways from the cribs, reverse wells, trenches, ditches, and ponds leading to adsorption of transuranic elements on vadose-zone soils are possibly the most significant. Specifically, the cribs of the 200-BP-1 Operable Unit (the "BY cribs") and the 216-B-5 Reverse Well are of particular concern. The cribs exceeded their specific retention capacity by a large amount and the reverse well discharged directly to groundwater. These and other pathways can be traced on the conceptual model. All are possible; only a few are likely because of the conservatism inherent in including all conceivable pathways. More importantly, even if a pathway carries significant levels of a contaminant, it still may not have carried contamination to the ultimate receptors, human or ecological. This can only be assessed by sampling at the exposure point on this pathway, or sampling at some other point and extrapolation to the exposure point, to indicate the dosage to the receptors.

There are significant uncertainties in the contaminant levels in the contaminant migration pathways shown on the conceptual model, yet almost none of these pathways has been sampled (an exception is the 200-BP-1 Operable Unit) to determine whether any contamination still exists in any of the locations implicated from the conceptual model, and if so which constituents, how much, and to what extent.

8.1.5 Aggregate Area Management Study Objectives and Decisions

The specific objectives of the B Plant AAMS are listed in Section 1.3. They include (in part) the following:

- Assemble site data (as described in Section 8.1.2)
- Develop a site conceptual model (see Section 8.1.4)
- Identify contaminants of concern and their distribution (Section 5.0)
- Identify preliminary applicable, or relevant and appropriate, regulations (ARARs, Section 6.0)
- Define preliminary remedial action objectives and screen potential remedial technologies to prepare preliminary remedial action alternatives (Section 7.0)
- Recommend expedited, interim, or limited actions (Section 9.0)
- Define and prioritize workplan activities with emphasis on supporting early cleanup actions and records of decision.

The decisions that will have to be made on the basis of this AAMS can best be described according to the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) flow chart (Figure 1-2 in Section 1.0) that must be conducted on a site-by-site basis. Decisions are shown on the flow chart as diamond-shaped boxes, and include the following:

- Is an ERA justified?
- Is less than six months response needed (is the ERA time critical)?
- Are data sufficient to formulate the conceptual model and perform a qualitative risk assessment?
- Is an IRM justified?
- Can the remedy be selected?
- Can additional required data be obtained by LFI?
- Are data (from field investigations) sufficient to perform risk assessment?

- Can an Operable Unit/Aggregate Area Record of Decision (ROD) be issued?

(The last two questions will only be asked after additional data are obtained through field investigations, and so are DQO issues only in assessing scoping for those investigations.)

Most of these decisions are actually a complicated mixture of many smaller questions, and will be addressed in Section 9.0 in a more detailed flowchart for assessing the need for remediation or investigation.

Similarly, the tasks that will need to be performed after the AAMS that drive the data needs for the study are found in the rectangular boxes on the flow chart. These include the following:

- ERA (if justified)
- Definition of threshold contamination levels, and formulation of conceptual model, performance of qualitative risk assessment and FS screening (IRM preliminaries)
- FFS for IRM selection
- Determination of minimum data requirements for IRM path
- Negotiation of Scope of Work, relative priority, and incorporation into integrated schedule, performance of LFI
- Determination of minimum data needs for risk assessment and final Remedy Selection (preparation of RI/FS pathway).

These stages of the investigation must be considered in assessing data needs (Section 8.2.2).

8.2 DATA USES AND NEEDS (STAGE 2 OF THE DQO PROCESS)

Stage 2 of the DQO development process (EPA 1987) defines data uses and specifies the types of data needed to meet the project objectives. These data uses and needs are based on the Stage 1 results, but must be more specific. The elements of this stage of the DQO process include:

- Identifying data uses (Section 8.2.1)

- Identifying data types (Section 8.2.2.1)

- Identifying data quality needs (Section 8.2.2.2)

- Identifying data quantity needs (Section 8.2.2.3)

- Evaluating sampling/analysis options (Section 8.2.2.4)

- Reviewing data quality parameters (Section 8.2.2.5)

- Summarizing data gaps (Section 8.2.3).

Stage 2 is developed on the basis of the conceptual model and the project objectives. These following sections discuss these issues in greater detail.

8.2.1 Data Uses

For the purposes of the remediation in the B Plant Aggregate Area, most data uses fall into one or more of four general categories:

- Site characterization

- Public health evaluation and human health and ecological risk assessments

- Evaluation of remedial action alternatives

- Worker health and safety.

Site characterization refers to a process that includes determination and evaluation of the physical and chemical properties of any wastes and contaminated media present at a site, and an evaluation of the nature and extent of contamination. This process normally involves the collection of basic geologic, hydrologic, and meteorologic data but more importantly for the B Plant Aggregate Area waste management units, data on specific contaminants and sources that can be incorporated into the conceptual model to indicate the relative significance of the various pathways. Site characterization is not an end in itself, as stressed in the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a), but rather the data must work toward the ultimate objectives of assessing the need for remediation (according to risk assessment methods, either qualitative or quantitative) and providing appropriate means of remediation (through an FFS, FS, or CMS). The understanding of the site characterization, based on existing data, is presented in Sections 2.0, 3.0, and 4.0, and summarized in the conceptual model (Section 4.2).

Data required to conduct a public health evaluation, and human health and ecological risk assessments at the sites in the B Plant Aggregate Area include the following: input parameters for various performance assessment models (e.g., the Multimedia Environmental Pollutant Assessment System); site characteristics; and contaminant data required to evaluate the threat to public and environmental health and welfare through exposure to the various media. These needs usually overlap with site characterization needs. An extensive discussion of risk assessment data uses and needs is presented in the *Risk Assessment Guidance for Superfund* (EPA 1989a). The main deficiency in the data available for waste management units in the B Plant Aggregate Area is that a quantitative assessment of contaminant concentrations for the purposes of risk assessment can be performed. The present understanding of site risks is presented in the selection of constituents of concern (Section 5.0). Quantitative risk assessments will be conducted at the Hanford Site with a methodology under development, and the data needs for this methodology will be considered in developing site specific sampling and analysis plans.

Data collected to support evaluation of remedial action alternatives for ERAs, IRMs, FFSs, or the full RI/FS, include site screening of alternatives, feasibility-level design, and preliminary cost estimates. Once an alternative is selected for implementation, much of the data collected during site investigations (LFI or RI) can also be used for the final engineering design. Generally, collection of information during the investigations specifically for use in the final design is not cost effective because many issues must be decided about appropriate technologies before effective data gathering can be undertaken. It is preferable to gather such specific information during a separate predesign investigation or at the time of remediation (i.e., the "observational approach" of the *Hanford Site Past-Practice Strategy* [DOE/RL 1992a]). Based on the existing data, broad remedial action technologies and objectives have been identified in Section 7.0.

The worker health and safety category includes data collected to establish the required level of protection for workers during various investigation activities. These data are used to determine if there is concern for the personnel working in the vicinity of the aggregate area. The results of these assessments are also used in the development of the various safety documents required for field work (see Health and Safety Plan, Appendix B).

It should be noted that each of these data use categories (site characterization, risk assessment needs, remedial actions, and health and safety) will be required at each decision point on the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) flow chart, as discussed at the end of Section 8.1.5. To the extent possible, however, not all sites will be investigated to the same degree but only those with the highest priority. These results will then be extended to the other, analogous sites which have similar geology and disposal histories (see Section 9.2.3).

The existing data can presently be used for two main purposes:

- Development of site-specific sampling plans (site characterization use)

- Screening for health and safety (worker health and safety use)

Table 8-1 presents a summary of the availability of existing data for these two uses.

For the purposes of developing sampling plans, existing information is available for:

- The location of sites--many of waste management units and unplanned releases have surface expressions, markers, or have been surveyed in the past. The unplanned releases in particular are lacking in this information, as well as the 216-E-25 Pond and the 2607-EB, 2607-EH, 2607-GF, 2607-E3, and 2607-E7B Septic Tanks.

- Possible contamination found at the waste management units--these data are derivable from the inventories for the waste management units (mainly for the specific retention trenches, cribs and other disposal facilities) as well as from the limited sampling which has been done at the 216-B-3, 216-B-3A, 216-B-3C, 216-N-8, and 2101-M Ponds and their tributary ditches (i.e., 216-B-3-3).

- The likely depth of contaminants--this information is mainly obtained from the gross gamma borehole logging for many of the units.

Two types of information are available for the purposes of worker health and safety, and will be used for the development of health and safety documents:

- Levels of surface radiation--derived from the on-going periodic radiological surveys done under the Environmental Surveillance program (Schmidt et al. 1991). Table 8-1 shows where surveys have indicated no detectable levels of surface radiation and so no additional survey is required before surface activities can be conducted.

- Expected maximum contaminant levels--these data can be based mainly on the results of subsurface soil sampling. Site-specific sampling of this type has been conducted for several B Plant Aggregate Area waste management units including the 216-B-3 Pond System, the 2101-M Pond, and the work being done for the remedial investigation of the 200-BP-1 Operable Unit.

Table 8-1 also presents a first expression of the data needs for the individual waste management units in the B Plant Aggregate Area, which must be addressed for remediation approaches to be developed.

8.2.2 Data Needs

The data needs for the B Plant Aggregate Area are discussed in the following sections according to the categories of types of data (Section 8.2.2.1), quality (8.2.2.2), quantity (8.2.2.3), options for acquiring the data (8.2.2.4), and appropriate DQO (PARCC) parameters (8.2.2.5). These considerations are summarized for each category of waste management unit site in the B Plant Aggregate Area (Section 8.2.3).

8.2.2.1 Data Types. Data use categories described in Section 8.2.1 define the general purpose of collecting additional data. Based on the intended uses, a concise statement regarding the data types needed can be developed. Data types specified at this stage should not be limited to chemical parameters, but should also include necessary physical parameters such as bulk density and moisture. Since environmental media and source materials are interrelated, data types used to evaluate one media may also be useful to characterize another media.

Identifying data types by media indicates that there are overlapping data needs. Data objectives proposed for collection in the site investigations at waste management units and unplanned releases in the B Plant Aggregate Area are discussed in Section 8.3 to provide focus to investigatory methods that may be employed. The data type requirements for the preliminary remedial action alternatives developed in Section 7.4 are summarized in Table 8-2.

8.2.2.2 Data Quality Needs. The various tasks and phases of a CERCLA investigation may require different levels of data quality. Important factors in defining data quality include selecting appropriate analytical levels and validation and identifying contaminant levels of concern as described below. The Westinghouse Hanford document, *A Proposed Data Quality Strategy for Hanford Site Characterization,* will be used to help define these levels (McCain and Johnson 1990).

Chemical and radionuclide laboratory analysis will be one of the most important data types, and is required at virtually all the sites in the B Plant Aggregate Area. In general, increasing accuracy, precision, and lower detection limits are obtained with increasing cost and time. Therefore, the analytical level used to obtain data should be commensurate with the intended use. Table 8-3 defines five analytical levels associated with different types of characterization efforts. While the bulk of the analysis during LFIs/RIs will be screening level (DQO Level I or II), these data will require confirmation sampling and analysis to allow final remedial decisions through quantitative risk assessment methods. Individual DQO analytical PARCC parameters for Level III or IV analytical data associated with each contaminant anticipated in the B Plant Aggregate Area (as developed in Section 5) are given in Table 8-4. These parameters will be used for the development of site-specific sampling and analysis plans and quality assurance plans for investigations and remediations in the aggregate area.

Before laboratory or even field data can be used in the selection of the final remedial action, they must first be validated. Exceptions are made for initial evaluations of the sites using existing data, which may not be appropriate for validation but will be used on a screening basis based on the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a). Other screening data (e.g., estimates of contaminant concentration inferred from field analyses) may also be excepted. Validation involves determining the usability and quality of the data. Once data are validated, they can be used to successfully complete the remedial action selection process. Activities involved in the data validation process include the following:

- Verification of chain-of-custody and sample holding times

- Confirmation that laboratory data meet Quality Assurance/Quality Control (QA/QC) criteria

- Confirmation of the usability and quality of field data, which includes geological logs, hydrologic data, and geophysical surveys

- Proper documentation and management of data so that they are usable.

Validation may be performed by qualified Westinghouse Hanford personnel from the Office of Sample Management (OSM), other Westinghouse Hanford organizations, or a qualified independent participant subcontractor. Data validation of laboratory analyses will be performed in accordance with *A Proposed Data Quality Strategy for Hanford Site Characterization* (McCain and Johnson 1990) and standards set forth by Westinghouse Hanford.

To accomplish the second point, all laboratory data must meet the requirements of the specific QA/QC parameters as set up in the Quality Assurance Project Plan (QAPP) for the project before it can be considered usable. The QA/QC parameters address laboratory precision and accuracy, method blanks, instrument calibration, and holding times.

The useability of field data must be assessed by a trained and qualified person. The project geohydrologist/geophysicists will review the geologic logs, hydrologic data, geophysical surveys, and results of physical testing, on a daily basis, and senior technical reviews will be conducted periodically throughout the project.

Data management procedures are also necessary for the validation. Data management includes proper documentation of field activities, sample management and tracking, and document and inventory control. Specific consistent procedures are discussed in the Data Management Plan (Appendix D).

8.2.2.3 Data Quantity Needs. The number of samples that need to be collected during an investigation can be determined by using several approaches. In instances where data are lacking or are limited (such as for contamination in the vadose zone soils), a phased sampling approach will be appropriate. In the absence of any available data, an approach or rationale will need to be developed to justify the sampling locations and the numbers of samples selected. Specific locations and numbers of samples will be determined based on data collected during screening activities. For example, the number and location of beta/gamma spectrometer probe locations can be based on results of surface geophysical and radiation surveys. These may help locate some subsurface features which may not be adequately documented. Details of any higher DQO level subsurface soil sampling scheme will depend on results of screening investigations such as geophysics surveys, surface radiation surveys, and beta/gamma spectrometer probe surveys. In situations where and when available data are more complete, statistical techniques may be useful in determining the additional data required.

8.2.2.4 Sampling and Analysis Options. Data collection activities are structured to obtain the needed data in a cost-effective manner. Developing a sampling and analysis approach that ensures that appropriate data quality and quantity are obtained with the resources available may be accomplished by using field screening techniques and focusing the higher DQO level analyses on a limited set of samples at each site. The investigations on sites in the B Plant Aggregate Area should take advantage of this approach for a comprehensive characterization of the site in a cost-effective manner.

A combination of lower level (Levels I, II, and III) and higher level analytical data (Levels IV and V) should be collected. For instance, at least one of the samples collected from each source (including contaminated surface soil at unplanned release locations) should be analyzed at DQO Level IV or V and validated to provide high quality data to confirm the less expensive but more extensive lower level analyses. This approach would provide the certainty necessary to determine contaminants present near the sources. Samples collected from the other media (i.e., subsurface soils, sediments) will be analyzed by *Test Methods for Evaluating Solid Wastes*, (EPA 1986), Contract Laboratory Program (EPA 1988a, 1989b), *Methods for Chemical Analysis of Water and Wastes* (EPA 1983), or *Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EPA 1980).

8.2.2.5 Data Quality Parameters. The PARCC parameters are indicators of data quality. Ideally, the end use of the data collected should define the necessary PARCC parameters. Once the PARCC requirements have been identified, then appropriate analytical methods can be chosen to meet established goals and requirements. Definitions of the PARCC parameters are presented in Section 8.1.2.

In general the precision and accuracy objectives are governed by the capabilities of the available methodologies and in most cases these are more than adequate for the needs of the investigations. Chemical analyses can usually attain parts per billion detection range in soils and water, and this level is adequate to the needs of the risk assessment for most analytes. Radiological analyses reach similar levels. Some constituents (e.g., arsenic) would require analysis to much lower levels, but this is impossible because of the limitations of analytical methods and the effects of natural background levels. In addition, risk assessment is conventionally computed only to a single digit of precision and uses conservative assumptions, which reduce the impact of measurements with lower accuracy.

For other measurements, such as physical parameters, the precision and accuracy capabilities of existing measurement technologies are sufficient for the evaluation methods used to produce characterization data, so the objectives are based on the limitations of the analysis methodologies.

Representativeness is maintained by fitting the sampling program to the governing aspects of the sources and transport processes of the site, as demonstrated in the site conceptual model (Section 4.2). Initial sampling should concentrate on sources, which are fairly well-understood, and on representative locations of anticipated transport mechanisms. If necessary, following activities can focus on aspects or locations that were not anticipated but were demonstrated by the more general results.

Completeness is generally attained by specifying redundancy on critical samples and maintaining quality control on their acquisition and analysis. As with representativeness, the initial sampling program may lead to modifications of which samples should be considered critical during subsequent sampling activities.

Comparability will be met through the use of Westinghouse Hanford standard procedures generally incorporated into the *Environmental Investigation and Site Characterization Manual* (WHC 1988d).

8.2.3 Data Gaps

Considering the data needs developed in Section 8.2.2, and the data available to meet these needs as presented in Section 8.1.2, it is apparent that a number of data gaps can be identified. These are summarized, on a waste management unit category basis, in Table 8-5, and should be the focus of LFIs on a waste management unit category basis, using the analogue sites approach. These contaminant concentration data are the highest priority because of the need to assess remediation and appropriate remedial actions for each site.

In addition to these data needs specifically addressing contamination problems at sites included for consideration in this aggregate area, there are general data needs which will be required for characterization of the possible transport pathways, as presented in the conceptual model, at locations away from the individual units. These general, non-site specific needs include characterization of the following:

- Geologic stratigraphy, particularly for possible perched water zones
- Air transport of contamination
- Ecological impacts and transport mechanisms (bio-uptake, bio-concentration, secondary receptors through predation)
- Potential releases from process effluent lines between facilities and to waste disposal sites.

All of these needs will have to be addressed in the data collection program (Section 8.3).

8.3 DATA COLLECTION PROGRAM (STAGE 3 OF THE DQO PROCESS)

The data collection program is Stage 3 of the process to develop DQOs. Conducting an investigation with a mixture of screening and higher-level data is a common method for optimizing the quantity and quality of the data collected. It would be very inefficient and overly expensive to specify beforehand all the types of samples and analyses that will yield the most complete and accurate understanding of the contamination and physical behavior of the site. Data adequate to achieve all the goals and objectives for remedial action decisions are obtained at a lower cost by using the information obtained in the field to focus the ongoing investigation and remediation process.

Initial sampling should collect new data believed most necessary to confirm and refine the conceptual model particularly at priority sites. Sampling may then be extended to further reduce uncertainty, to fill in remaining data gaps, to collect more detailed information for certain points where such information is required, or to conduct any needed treatability studies or otherwise support the data needs of the remedial action selection process. An alternative of extrapolating the data from a limited number of sites to other analogous ones will also be used. The need for subsequent investigation phases will be assessed throughout the investigation and remediation activities as data become available. Assessing completeness of the investigation data through a formal statistical procedure is not possible, given the complexity and uncertainty of the parameters required to describe the site and the time to make decisions. Rather, the use of engineering judgement is considered sufficient to the decision process.

8.3.1 General Rationale

The general rationale for the investigation of sites in the B Plant Aggregate Area is to collect needed data that are not available. Because of the size of the aggregate area, the complexity of past operations, and the number of unplanned releases and waste management units, a large amount of new information will be required such as the specific radionuclides and chemicals present, their spatial distribution and form, and the presence of special migration pathways (such as perched groundwater systems).

The following work plan approach will be used for LFIs and RI/FS in the B Plant Aggregate Area. The results are described in Sections 8.3.2 and 8.3.3 in a general form.

- Existing data as described in Sections 2.0, 3.0, and 4.0 should be used to the maximum extent possible. Although existing data are not validated fully, the data are still useful in developing a preliminary conceptual model (Section 4.2) and in helping to focus and guide the planning of investigations, expedited actions, and interim measures.

- Additional data at validated and screening levels should be collected to obtain the maximum amount of useful information for the amount of time and resources invested in the investigation.

- Data should be collected to support the intended data uses identified in Section 8.2.1.

- Nonintrusive sampling (e.g., geophysical surveys, surface radiation surveys, soil gas, and spectral gamma probe surveys), and surficial and source sampling should be conducted early in any investigation effort to identify necessary interim response actions (i.e., additional ERAs or IRMs).

- Data collected from initial investigation activities should be used to confirm and refine the conceptual model (Section 4.2), refine the analyte constituents of concern, and provide information to conduct interim response actions or risk assessment activities.

- Additional investigation activities are proposed to support (if needed) quantitative baseline risk assessments for final cleanup actions and further refine the conceptual model.

- Field investigation techniques should be used to minimize the amount of hazardous or mixed waste generated. Any waste generated will be in accordance with EII 4.2, "Interim Control of Unknown Suspected Hazardous and Mixed Waste" (WHC 1988d).

8.3.2 General Strategy

The overall objective of any field investigation (LFI, IRM, or RI) of the sites in the B Plant Aggregate Area will be to gather additional information to support risk assessment and remedial action selection according to the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) flow chart discussed in Section 8.1.5. The general approach or strategy for obtaining this additional information is presented below.

- Analytical parameter selection should be based on verifying overall conditions and then narrowed to specific constituents of concern, in consideration with regulatory requirements and site conditions. Periodic analyses of the long list of parameters should be conducted to verify that the list of constituents of concern has not changed, either because new constituents are identified or some of those considered as a potential concern do not appear to be significant.

- Similarly, investigations should work from a screening level (DQO Levels I or II, e.g., surface radiation surveys) to successively more specific sampling and analysis methodologies (e.g., beta/gamma spectral probes, then DQO Level III or IV soil sampling and analysis), without time consuming remobilizations.

- Dangerous and radioactive wastes may be generated during the field investigation. While efforts should be made to minimize these wastes, any waste generated will be handled in accordance with EII 4.2, "Interim Control of Unknown Suspected

Hazardous and Mixed Waste" (WHC 1988d). The analyses of samples for constituents of concern analytes will allow wastes generated to be adequately designated.

8.3.3 Investigation Methodology

Initial field investigations (mainly LFIs, but also associated with IRMs at appropriate sites and possibly some RIs) may include some or all of the following integrated methodologies:

- Source Investigation (Section 8.3.3.1)
- Geological Investigation (Section 8.3.3.2)
- Surface Water Sediment Investigation (Section 8.3.3.3)
- Soil Investigation (Section 8.3.3.4)
- Air Investigation (Section 8.3.3.5)
- Ecological Investigation (Section 8.3.3.6)
- Geophysical Stratigraphic Survey (Section 8.3.3.7)
- Process Effluent Pipeline Integrity Assessment (Section 8.3.3.8)
- Geodetic Survey (Section 8.3.3.9).

Each investigation methodology is briefly outlined in the following sections. Specific survey methods (such as electromagnetics or ground-penetrating radar) have not been recommended to allow flexibility in the development of field sampling plans which can be sensitive to very local conditions. A summary of the applicable methods for each waste management unit is presented in Table 8-6. In addition, some of the data needs must be addressed on an area-wide basis (e.g., stratigraphy interpretation). More detailed descriptions and specific methods and instrumentation will be included in site-specific work plans, sampling and analysis plans, and field sampling plans for LFIs/IRMs at waste management units that require these investigations.

These investigations are presented in the approximate priority of their need, with the source investigation first because of its importance to the decisions about remedial action on a site-by-site basis. The other investigations are of lower priority, and should be conducted according to the need to determine whether contamination has been transported beyond the immediate vicinity of the waste management units. To some extent this need will depend on the results of the source investigation.

8.3.3.1 Source Investigation. The purpose of source investigation activities in the B Plant Aggregate Area is to characterize the known waste management units and unplanned releases that exist in the area and that may contribute to contamination of surface soil, vadose zone, surface water, sediment, air, and biota. The completeness of the characterization effort will be assessed according to the needs of risk assessment and remedial action selection, which will also determine what levels of the various constituents of concern comprise "contamination."

Source sampling should be conducted at waste management units or unplanned release locations where the available data indicate that dangerous, mixed, or radioactive wastes may be present. Activities which are proposed to be performed during the source investigations include the following:

- Compile and evaluate additional existing data for the purpose of: verifying locations, specifications of engineered facilities, and pipelines, and waste stream characteristics; assessment of the construction and condition of boreholes/wells that exist in the operable unit and their suitability for use for investigation activities, QA/QC information, and raw data regarding radiological and hazardous substances monitoring; and integrating any additional environmental modeling data into the conceptual model. This has been done (on an aggregate area basis) in this report; the process will be extended to site-specific planning and on-going assessments of the investigation/remediation as it is carried out.

- Conduct surface radiological survey of suspected or known source areas to verify locations and nature of surface and subsurface radiological contamination. Conditions at specific sources within a waste management unit should also be noted in order to plan sampling/remediation activities and worker health and safety.

- Conduct nonintrusive surface geophysical surveys at specific waste management units such as the 216-E-25 Pond (Section 2.3.5.5) and the 2607-EB, 2607-EH, 2607-GF, 2607-E3, and 2607-E7B Septic Tanks (Sections 2.3.6.1, 2.3.6.2, 2.3.6.8, 2.3.6.13, and 2.3.6.15), and unplanned release locations to verify locations and physical characteristics of source locations. Data generated from these activities can be used in planning intrusive source sampling activities and in locating buried structure identified with waste management units.

- Conduct beta/gamma spectrometer probe survey to screen for near-surface contamination and to confirm the absence or presence of some specific radionuclides, which may be of particular concern. Existing boreholes will be used to the maximum extent, but new boreholes may be needed at many locations (to be decided based on screening results). Logging will be done both by NaI detectors or μR meters for rapid screening as well as the RLS high purity germanium logging system. Westinghouse Hanford will develop an EII Procedure for the beta/gamma spectrometer probe survey. The beta/gamma spectrometer probe survey serves two purposes depending on the source conditions: to confirm absence of contamination in the near-surface soils, and to serve as a screening tool to choose locations and quantities of vadose zone soil borings. The RLS procedure could demonstrate "assay quality" data for radionuclide concentrations, but will probably continue to require supporting Level IV soil analysis data to allow a risk assessment before final remedial decisions. The need to conduct this survey will be based (at least in part) on the screening results of the surface survey and on information about site burial.

- Soil gas surveys should be conducted at waste management units (such as cribs) where volatile organic chemicals are suspected, as a screening method to identify compounds such as solvents and degreasers that may have been used in separate processes or decontamination activities. The soil gas survey should not be considered conclusive that volatile organic compounds at lower concentrations may not be present. Data from the soil gas survey can be used to help locate surface and near-surface samples and vadose zone borings.

- Collect surface and near-surface samples of contaminated soils and/or waste materials at selected locations. Specific sampling sites will be chosen to assess particular facilities or releases. Additional sampling sites may be specified based on results from nonintrusive investigations.

- Wipe samples should be collected as part of the investigations of surface contamination or building (piping or pavement) surfaces. The wipe sample locations can be chosen based on visual observations and a surface radiation survey conducted during a site walkthrough. The methodology may be limited by the presence of soil, rough concrete, or paving and so may not be heavily used except as confirmation following removal of loose contamination.

8.3.3.2 Geologic Investigation. A geologic investigation should be performed to better characterize the vadose zone and the nature of unsaturated soils that make up this system. This investigation is exclusive of contamination. The geologic investigation will include the following tasks:

- Borings may be advanced into zones where an accurate interpolation of the subsurface stratigraphy is important to understanding migration pathways in the vadose zone.

- Geologic data collected during the ongoing vadose zone soil (Section 8.3.3.4) and other (deeper) investigations (e.g., geologic and geophysical logs from groundwater well installations for groundwater AAMSs) will be compared, compiled, and evaluated.

8.3.3.3 Surface Water Sediment Investigation. A surface water sediment investigation should be conducted. The investigation will include:

- Radiation survey along ditches, trenches, and ponds for health and safety purposes and to locate areas of elevated radiation for selection of specific sediment sampling locations.

- Sampling of sediment in any ditches, ponds, and trenches that still contain water. This will probably be limited to the 216-B-3-3 and 216-B-63 Ditches, the 207-B Retention Basin, and the 216-N-8, 216-B-3, and 216-B-3C Ponds.

8.3.3.4 Soil Investigation. The purpose of soil investigations is to determine physical and chemical properties of the soil and to determine the nature, type, and extent of soil contamination associated with waste management units and unplanned releases to allow initiation of interim remedial actions and to assess the quantitative risk at other sites. Sampling will include:

- Samples of vadose zone soil will be collected and analyzed for contaminants when wells are drilled for other studies (i.e., groundwater investigations) in the vicinity of a waste management unit or unplanned release with reported liquid disposals or spills. Organic vapor (at sites with suspected volatiles) and radiation sampling should also be performed with samples selected by onsite screening.

- Data collected during this investigation will be evaluated to further understand the deposition of contaminants to the vadose zone from specific waste management units and/or unplanned releases and to better define the hydrology and water quality in the vadose zone system through moisture content profiles and tracking of specific contaminants.

8.3.3.5 Air Investigation. Air investigations (on an aggregate area scale) should consist of onsite particle sampling as part of the health and safety program. In addition, high-volume air samplers should be placed in appropriate locations on-site based on evaluation of existing meteorological data. The purpose of these samplers will be to determine if any migration of airborne contaminants occurs.

8.3.3.6 Ecological Investigation. Ecological investigation activities, on an aggregate area scale, should include a literature search and data review, and a site walkthrough. These activities are intended to identify potential biota concerns which need to be addressed in the site investigation. Particular emphasis should be given to identifying potential exposure pathways to biota that migrate offsite or that introduce contaminants into the food web.

8.3.3.7 Geophysical Stratigraphic Survey. Additional information needs to be gathered to better define the depth and lateral extent of the perched water zones and the caliche layer (an important aquitard) in the Plio-Pleistocene unit. This information may be obtained using a number of subsurface characterization techniques such as magnetic and seismic surveys and borehole logging.

8.3.3.8 Process Effluent Pipeline Integrity Assessment. An assessment of process effluent pipeline integrity should be conducted early in site investigation activities to look for potential leaks and therefore possible areas of contamination. Initially, as part of this effort, drawings of the process lines and encasements within the aggregate area (Section 2.3.7) should be reviewed and their construction, installation, and operation evaluated. Specific lines will then be selected for integrity assessment with emphasis on lines serving the waste management units that have received large volumes of liquid (e.g., cribs). Investigation of operating high level waste transfer lines will be deferred to their respective programs. Results of the integrity assessments will be evaluated and additional sampling activities may be recommended for subsequent studies.

8.3.3.9 Geodetic Survey. Geodetic surveys will be conducted after the installation and completion of each investigation activity. The survey will be to locate the horizontal locations of surface and near-surface soil samples; corners of geophysics, soil gas, and beta/gamma probe surveys; and surface water and sediment sample locations. Horizontal and vertical locations of all vadose zone soil borings and perched zone wells will be surveyed. The geodetic survey should be conducted by a professional surveyor licensed in the state of Washington and should be referenced to both historic (e.g., Hanford coordinates) and current coordinate datums (e.g., North American Datum of 1983 - NAD-83), both vertical and horizontal.

8.3.4 Data Evaluation and Decision Making

Data will be evaluated as soon as results (e.g., soil gas, radiation screening, drilling results) become available for use in restructuring and focusing the investigation activities.

Data reports will be developed that summarize and interpret new data. This includes groundwater sampling and RLS borehole logging as part of the AAMS. Data will be used to refine the conceptual model, further assess potential contaminant-specific ARARs, develop the quantitative risk assessment, and assess remedial action alternatives.

The objectives of data evaluation are:

- To reduce and integrate data to ensure that data gaps are identified and that the goals and objectives of the B Plant AAMS are met

- To confirm that data are representative of the media sampled and that QA/QC criteria have been met.

Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units.

Page 1 of 6

Waste Management Unit	Type of Unit	Development of Sampling Plans: Field Located	Development of Sampling Plans: Possible Contamination	Development of Sampling Plans: Depth Contamination	Health and Safety: Surface[a/] Radiation	Expected Max. Level
Tanks and Vaults						
241-B-361	Settling Tank	•	•	--	•	--
Cribs and Drains						
216-B-7A	Crib	•	•	•	--	•
216-B-7B	Crib	•	•	•	--	•
216-B-8TF	Crib/Tile Field	•	•	•	--	•
216-B-9TF	Crib/Tile Field	•	•	•	•	•
216-B-10A	Crib	•	•	•	--	•
216-B-10B	Crib	•	•	--	--	•
216-B-12	Crib	•	•	•	--	•
216-B-14	Crib	•	•	•	•	•
216-B-15	Crib	•	•	•	•	•
216-B-16	Crib	•	•	•	•	•
216-B-17	Crib	•	•	•	•	•
216-B-18	Crib	•	•	•	•	•
216-B-19	Crib	•	•	•	•	•
216-B-43	Crib	•	•	•	•	•
216-B-44	Crib	•	•	•	•	•
216-B-45	Crib	•	•	•	•	•
216-B-46	Crib	•	•	•	•	•
216-B-47	Crib	•	•	•	•	•
216-B-48	Crib	•	•	•	•	•
216-B-49	Crib	•	•	•	•	•
216-B-50	Crib	•	•	•	•	•
216-B-55	Crib	•	•	•	--	•
216-B-56	Crib	•	--	--	--	--
216-B-57	Crib	•	•	•	•	•
216-B-60	Crib	--	•	--	--	--
216-B-61	Crib	•	--	--	--	--
216-B-62	Crib	•	•	•	--	•

Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units. Page 2 of 6

Waste Management Unit	Type of Unit	Development of Sampling Plans: Field Located	Development of Sampling Plans: Possible Contamination	Development of Sampling Plans: Depth Contamination	Health and Safety: Surface[a/] Radiation	Expected Max. Level
CTF N. of 2703-E	--	--	--	--	--	--
216-B-13	French Drain	•	•	•	•	--
216-B-51	French Drain	•	•	--	•	--
Reverse Wells						
216-B-4	Reverse Well	•	•	•	--	•
216-B-5	Reverse Well	•	•	•	•	•
216-B-6	Reverse Well	•	•	•	--	•
216-B-11A	Reverse Well	•	•	•	•	•
216-B-11B	Reverse Well	•	•	•	•	•
Ponds, Ditches, and Trenches						
216-B-3	Pond	•	•	•	--	•
216-B-3A	Pond	•	•	--	•	--
216-B-3B	Pond	•	•	--	•	--
216-B-3C	Pond	•	•	--	•	--
216-A-25	Pond	•	•	•	•	•
216-E-28	Pond	•	--	--	•	--
216-N-8	Pond	--	--	--	--	•
216-B-2-1	Ditch	•	•	•	--	•
216-B-2-2	Ditch	•	•	•	--	•
216-B-2-3	Ditch	•	•	•	--	•
216-B-3-1	Ditch	•	•	•	•	--
216-B-3-2	Ditch	•	•	•	•	--
216-B-3-3	Ditch	•	•	•	•	--
216-B-20	Trench	•	•	•	--	•
216-B-21	Trench	•	•	•	--	•
216-B-22	Trench	•	•	•	--	•
216-B-23	Trench	•	•	•	--	•

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Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units. Page 3 of 6

		Development of Sampling Plans			Health and Safety	
Waste Management Unit	Type of Unit	Field Located	Possible Contamination	Depth Contamination	Surface[a/] Radiation	Expected Max. Level
216-B-24	Trench	•	•	•	--	•
216-B-25	Trench	•	•	•	--	•
216-B-26	Trench	•	•	•	--	•
216-B-27	Trench	•	•	•	--	•
216-B-28	Trench	•	•	•	--	•
216-B-29	Trench	•	•	•	--	•
216-B-30	Trench	•	•	•	--	•
216-B-31	Trench	•	•	•	--	•
216-B-32	Trench	•	•	•	--	•
216-B-33	Trench	•	•	•	--	•
216-B-34	Trench	•	•	•	--	•
216-B-35	Trench	•	•	•	--	•
216-B-36	Trench	•	•	•	--	•
216-B-37	Trench	•	•	•	--	•
216-B-38	Trench	•	•	•	--	•
216-B-39	Trench	•	•	•	--	•
216-B-40	Trench	•	•	•	--	•
216-B-41	Trench	•	•	•	--	•
216-B-42	Trench	•	•	•	--	•
216-B-52	Trench	•	•	•	•	•
216-B-53A	Trench	•	•	--	--	•
216-B-53B	Trench	•	•	•	--	•
216-B-54	Trench	•	•	•	•	•
216-B-58	Trench	•	•	--	--	•
216-B-63	Ditch	•	•	•	--	•
Septic Tanks and Associated Drain Fields						
2607-E1	Septic Tank	•	--	--	--	--
2607-E2	Septic Tank/Drain Field	•	--	--	--	--
2607-E3	Septic Tank/Drain Field	•	--	--	--	--

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Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units. Page 4 of 6

Waste Management Unit	Type of Unit	Development of Sampling Plans: Field Located	Development of Sampling Plans: Possible Contamination	Development of Sampling Plans: Depth Contamination	Health and Safety: Surface[a/] Radiation	Health and Safety: Expected Max. Level
2607-E4	Septic Tank/Drain Field	•	•	--	--	--
2607-E7B	Septic Tank/Drain Field	--	--	--	--	--
2607-E8	Septic Tank/Drain Field	•	--	--	--	--
2607-E9	Septic Tank	--	--	--	--	--
2607-E11	Septic Tank	•	--	--	--	--
2607-EB	Septic Tank/Drain Field	•	--	--	--	--
2607-EH	Septic Tank/Drain Field	--	--	--	--	--
2607-EK	Septic Tank/Drain Field	•	--	--	--	--
2607-EM	Septic Tank	--	--	--	--	--
2607-EN	Septic Tank	--	--	--	--	--
2607-EO	Septic Tank	•	--	--	--	--
2607-EP	Septic Tank/Drain Field	•	--	--	--	--
2607-EQ	Septic Tank/Drain Field	•	--	--	--	--
2607-ER	Septic Tank	--	--	--	--	--
2607-GF	Septic Tank/Drain Field	--	--	--	--	--
Basins						
207-B	Retention Basin	•	•	--	--	--

Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units. Page 5 of 6

Waste Management Unit	Type of Unit	Development of Sampling Plans: Field Located	Development of Sampling Plans: Possible Contamination	Development of Sampling Plans: Depth Contamination	Health and Safety: Surface[a/] Radiation	Expected Max. Level
216-B-59B	Retention Basin	•	•	•	--	•
216-B-64	Retention Basin	•	•	--	•	--
Burial Sites						
218-E-2	Burial Ground	•	•	•	•	•
218-E-2A	Burial Ground	•	--	•	--	--
218-E-3	Burial Ground	--	--	•	--	--
218-E-4	Burial Ground	•	•	--	--	•
218-E-5	Burial Ground	•	•	--	•	--
218-E-5A	Burial Ground	•	•	--	•	--
218-E-6	Burial Ground	--	--	--	--	--
218-E-7	Burial Ground	•	•	•	•	•
218-E-9	Burial Ground	•	•	--	•	--
200 Area Construction Pit		--	--	--	--	--
Unplanned Releases						
UN-200-E-7		--	•	--	--	--
UN-200-E-9		•	•		•	--
UN-200-E-14		--	--	--	--	--
UN-200-E-41		--	•	--	•	--
UN-200-E-43		--	•	--	•	•
UN-200-E-44		--	•	•	•	•
UN-200-E-52		--	•	•	•	•
UN-200-E-54		--	--	--	--	--
UN-200-E-55		--	--	--	--	--
UN-200-E-61		•	--	--	--	--
UN-200-E-63		•	--	--	•	--

Table 8-1. Uses of Existing Data for B Plant Aggregate Area Waste Management Units. Page 6 of 6

		Development of Sampling Plans			Health and Safety	
Waste Management Unit	Type of Unit	Field Located	Possible Contamination	Depth Contamination	Surface[a] Radiation	Expected Max. Level
UN-200-E-64		•	•	--	•	--
UN-200-E-69		--	•	--	•	•
UN-200-E-79		--	•	•	•	--
UN-200-E-80		--	--	•	•	--
UN-200-E-83		•	•	--	•	--
UN-200-E-87		•	--	•	--	•
UN-200-E-90		•	--	--	•	--
UN-200-E-92		--	--	--	--	--
UN-200-E-95		•	•	--	•	•
UN-200-E-101		--	--	--	•	--
UN-200-E-103		--	•	•	•	--
UN-200-E-112		--	--	--	•	--
UN-200-E-140		--	--	--	--	--
UPR-200-E-4		--	•	--	•	•
UPR-200-E-32		--	•	•	•	--
UPR-200-E-34		--	•	•	•	--
UPR-200-E-51		--	--	--	--	--
UPR-200-E-84		--	•	•	•	•
UPR-200-E-138		--	•	•	--	--

[a] A "•" indicates that the site has been surveyed and surface contamination has not been found to be present.

Table 8-2. Data Needs for Preliminary Remedial Action Alternatives B Plant Aggregate Area.

Alternative	Physical Attribute	Chemical/Radiochemical Attribute
1. Multimedia Cover (plus possible vertical barriers)	• areal extent • depth of contamination • structural integrity (collapse potential) • run-off/run-on potential • cover properties (permeability)	• surface radiation • biologic transport potential
2. In Situ Grouting/ Stabilization	• areal extent • depth • particle size • hydraulic properties (permeability/porosity) • stratigraphy • borehole spacing • grout/additive mix parameters	• solubility • reactivity • leachability from grout medium
3. Excavation, Soil Treatment, and Disposal	• areal extent[a/] • depth[a/] • particle size • silt-size (dust) content • excavation stability	• toxicity/radioactivity • levels of contaminants • solubility/reactivity • soil chemistry (relative affinity) • concentrations in PM-10 fraction • spent solvent treatment/disposal options
4. In Situ vitrification	• areal extent • depth • soil/waste conductivity • thermal properties • moisture contact • voids	• volatility • reactivity • leachability/integrity • off-gas treatment waste disposal options
5. Excavation, Above Ground Treatment, and Geologic Disposal	• areal extent[a/] • depth[a/] • mineralogy of soil/waste • particle size • silt-size (dust) content • excavation stability • treatment parameters	• concentrations of TRU • toxicity/radioactivity • levels of contaminants • concentrations in PM-10 fraction • reactivity • leachability/integrity of final waste form
6. In Situ Soil Vapor Extraction	• areal extent • depth • locations/depth of highest concentrations (vapors, adsorbed) • stratigraphy • soil permeability/porosity • voids	• volatility of constituents (Henry's Law Constant) • non-volatile organics • levels • volatile radionuclides (Radon) • treatability (catalytic oxidization)

[a/] May be obtained during remediation using the observational approach recommended by the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a)

Table 8-3. Analytical Levels for the B Plant Aggregate Area.

Level	Description
LEVEL I	Field screening. This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.
LEVEL II	Field analysis. This level is characterized by the use of portable analytical instruments which can be used onsite, or in mobile laboratories stationed near a site (close-support laboratories). Depending on the types of contaminants, sample matrix, and personnel skill, qualitative and quantitative data can be obtained.
LEVEL III	Laboratory analysis using methods other than the Contract Laboratory Program (CLP) Routine Analytical Services (RAS). This level is used primarily in support of engineering studies using standard EPA-approved procedures. Some procedures may be equivalent to CLP RAS without the CLP requirements for documentation.
LEVEL IV	Contract Laboratory Program (CLP) Routine Analytical Services (RAS). This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data. Some regions have obtained similar support via their own regional laboratories, university laboratories, or other commercial laboratories.
LEVEL V	Nonstandard methods. Analyses which may require method modification and/or development are considered Level V by CLP Special Analytical Services (SAS).

Table 8-4. Data Quality Objective Parameters for Chemical/Radiochemical Analyses.

	Soil/Sediment				Water			
	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)
RADIONUCLIDES								
Gross Alpha	900.0 M	TBD	±30	±25	900.0	10	±25	±25
Gross Beta	900.0 M	TBD	±30	±25	900.0	5	±25	±25
Gamma Scan	D3699 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Actinium-225	907.0 M	TBD	±30	±25	907.0	TBD	±25	±25
Actinium-227	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Americium-241	Am-01	TBD	±30	±25	Am-03	TBD	±25	±25
Americium-242	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Americium-242m	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Americium-243	Am-01	TBD	±30	±25	Am-03	TBD	±25	±25
Antimony-126	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Antimony-126m	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Barium-137m	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Bismuth-210	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Bismuth-211	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Bismuth-213	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Bismuth-214	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Carbon-14	C-01 M	TBD	±30	±25	TBD	TBD	±25	±25
Cesium-134	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Cesium-135	901.0 M	TBD	±30	±25	901.0	TBD	±25	±25
Cesium-137	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Cobalt-60	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Curium-242	907.0 M	TBD	±30	±25	907.0	TBD	±25	±25
Curium-244	907.0 M	TBD	±30	±25	907.0	TBD	±25	±25
Curium-245	907.0 M	TBD	±30	±25	907.0	TBD	±25	±25
Europium-152	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Europium-154	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25

Table 8-4. Data Quality Objective Parameters for Chemical/Radiochemical Analyses.

	Soil/Sediment				Water			
	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)
RADIONUCLIDES (cont.)								
Europium-155	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Francium-221	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Iodine-129	902.0 M	TBD	±30	±25	902.0	TBD	±25	±25
Lead-209	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Lead-210	Pb-01 M	TBD	±30	±25	Pb-01	TBD	±25	±25
Lead-211	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Lead-212	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Lead-214	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Neptunium-237	907.0 M	TBD	±30	±25	907.0	TBD	±25	±25
Neptunium-239	D35649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Nickel-59	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Nickel-63	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Niobium-93m	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Plutonium	Pu-02	TBD	±30	±25	Pu-10	TBD	±25	±25
Plutonium-238	Pu-02	TBD	±30	±25	Pu-10	TBD	±25	±25
Plutonium-239/240	Pu-02	TBD	±30	±25	Pu-10	TBD	±25	±25
Plutonium-241	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Polonium-214	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Polonium-215	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Polonium-218	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Potassium-40	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Protactinium-231	TBD	TBD	±30	±25	TBD	TBD	±25	±25

Table 8-4. Data Quality Objective Parameters for Chemical/Radiochemical Analyses.

	Soil/Sediment				Water			
	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)	Analysis Method	Practical Quantitation Limit (pCi/g)	Precision (RPD)	Accuracy (%)
RADIONUCLIDES (cont.)								
Protactinium-234m	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Radium	Ra-04	TBD	±30	±25	Ra-05	TBD	±25	±25
Radium-225	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Radium-226	Ra-04	TBD	±30	±25	Ra-05	TBD	±25	±25
Ruthenium-106	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Samarium-151	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Selenium-79	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Sodium-22	D3649 M	TBD	±30	±25	D3649 M	TBD	±25	±25
Strontium-90	Sr-02	TBD	±30	±25	Sr-02	TBD	±25	±25
Technetium-99	Tc-01 M	TBD	±30	±25	Tc-01	TBD	±25	±25
Thallium-207	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Thorium-227	00-06	TBD	±30	±25	00-07	TBD	±25	±25
Thorium-229	00-06	TBD	±30	±25	00-07	TBD	±25	±25
Thorium-230	00-06	TBD	±30	±25	00-07	TBD	±25	±25
Thorium-231	TBD	TBD	±30	±25	TBD	TBD	±25	±25
Tritium	906.0 M	TBD	±30	±25	906.0	300	±25	±25
Uranium	U-04	TBD	±30	±25	U-04	TBD	±25	±25
Uranium-233	U	TBD	±30	±25	908.0	TBD	±25	±25
Uranium-234	U	TBD	±30	±25	908.0	TBD	±25	±25
Uranium-235	U	TBD	±30	±25	908.0	TBD	±25	±25
Uranium-238	U	TBD	±30	±25	908.0	TBD	±25	±25
Yttrium-90	Sr-02	TBD	±30	±25	Sr-02	TBD	±25	±25
Zirconium-93	TBD	TBD	±30	±25	TBD	TBD	±25	±25

Table 8-4. Data Quality Objective Parameters for Chemical/Radiochemical Analyses. Page 4 of 5

	Soil/Sediment				Water			
	Analysis Method	Practical Quantitation Limit (mg/kg)	Precision (RPD)	Accuracy (%)	Analysis Method	Practical Quantitation Limit (μg/L)	Precision (RPD)	Accuracy (%)
INORGANICS								
Arsenic	7061	0.02	±25	±30	7061	10	±20	±25
Barium	6010	0.02	±25	±30	6010	20	±20	±25
Boron	6010	TBD	±25	±30	6010	TBD	±20	±25
Cadmium	6010	0.09	±25	±30	6010	1	±20	±25
Chromium	6010	0.07	±25	±30	6010	10	±20	±25
Copper	6010	0.06	±25	±30	220.2	10	±20	±25
Cyanide	9010	TBD	±25	±30	335.3	50	±20	±25
Fluoride	300 M	TBD	±25	±30	300	50	±20	±25
Iron	6010	20	±25	±30	6010	70	±20	±25
Lead	6010	0.45	±25	±30	6010	450	±20	±25
Manganese	6010	0.02	±25	±30	6010	20	±20	±25
Mercury	7471	0.02	±25	±30	245.2	2	±20	±25
Nickel	6010	1.5	±25	±30	6010	50	±20	±25
Nitrate	300 M	TBD	±25	±30	300	130	±20	±25
Nitrite	300 M	TBD	±25	±30	300	40	±20	±25
Selenium	6010	0.75	±25	±30	270.2	20	±20	±25
Silver	6010	2	±25	±30	272.2	10	±20	±25
Titanium	6010	TBD	±25	±30	6010	TBD	±20	±25
Vanadium	6010	0.08	±25	±30	286.2	40	±20	±25
Zinc	6010	0.02	±25	±30	6010	20	±20	±25

Table 8-4. Data Quality Objective Parameters for Chemical/Radiochemical Analyses.

	Soil/Sediment				Water			
	Analysis Method	Practical Quantitation Limit (mg/kg)	Precision (RPD)	Accuracy (%)	Analysis Method	Practical Quantitation Limit (μg/L)	Precision (RPD)	Accuracy (%)
ORGANICS								
Acetone	8240	0.1	±25	±30	8240	100	±20	±25
Carbon tetrachloride	8240	0.005	±25	±30	8240	1	±20	±25
Chloroform	8240	0.005	±25	±30	8240	5	±20	±25
Kerosene	8015	20	±35	±30	8015	500	±35	±25
Methylene chloride	8240	0.005	±25	±30	8240	5	±20	±25
1,1,1-Trichloroethane	8240	0.005	±25	±30	8240	5	±20	±25
Toluene	8240	0.005	±25	±30	8240	5	±20	±25
Tributyl phosphate	TBD	TBD	±25	±30	TBD	TBD	±30	±25

TBD = To Be Determined
M = method modified to include extraction from the solid medium, extraction method is matrix and laboratory-specific
RPD = Relative Percent Difference
Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA 1980)
Test Methods for Evaluating Solid Wastes (SW 846) Third Edition (EPA 1986)
Methods for Chemical Analysis of Water and Wastes (EPA 1983)
Precision and accuracy are goals. Since these parameters are highly matrix dependent they could vary greatly from the goals listed.

Table 8-5. Data Gaps by Site Category.

Site Category	Identified Data Gaps
Tanks and Vaults	• Contaminant concentrations in waste management units other than single-shell tanks • Distribution of contaminants in subsurface soils released in leaks • Constituents concentrations in related surface contamination
Cribs and Drains	• Containment concentrations in cribs • Containment concentrations in soils beneath cribs • Specific constituents (especially organic chemicals) • Distribution and vertical/lateral extent of contamination
Reverse Wells	• Containment concentrations in subsurface soils impacted by discharges • Specific constituents (especially organics) • Extent of contamination
Ponds, Ditches, and Trenches	• Distribution/extent of subsurface contamination • Buried contaminant concentrations in stabilized portions/units • Extent of contamination in pond sediments
Septic Tanks and Associated Drain Fields	• Actual discharge levels • Possible discharge and presence/level of non-sanitary wastes (e.g., laboratory drains)
Transfer Facilities, Diversion Boxes, and Pipelines	• Contamination constituents and concentrations • Direct radiation levels in facilities • Constituents/concentrations in related surface contamination • Integrity of transfer lines
Basins	• Constituents and concentrations in sediments • Distribution/extent of subsurface contamination
Burial Sites	• Identify subsurface location of burial sites • Distribution/extent of subsurface contamination
Unplanned Releases	• Surface soil constituents and concentrations • Buried contamination constituents and concentrations

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
Tanks and Vaults									
241-B-361 Settling Tank	•	•	–	–	•	–	–	•	–
Cribs and Drains									
216-B-7A Crib	•	•	–	–	•	–	–	•	–
216-B-7B Crib	•	•	–	–	•	–	–	•	–
216-B-8TF Crib/Tile Field	•	•	–	–	•	–	–	•	–
216-B-9TF Crib/Tile Field	•	•	–	–	•	–	–	•	–
216-B-10A Crib	–	•	–	–	•	–	–	•	–
216-B-10B Crib	–	•	–	–	•	–	–	•	–
216-B-12 Crib	•	•	–	–	•	–	–	•	–
216-B-14 Crib	•	•	–	–	•	–	–	•	–
216-B-15 Crib	•	•	–	–	•	–	–	•	–
216-B-16 Crib	•	•	–	–	•	–	–	•	–
216-B-17 Crib	•	•	–	–	•	–	–	•	–
216-B-18 Crib	•	–	–	–	•	–	–	•	–
216-B-19 Crib	•	•	–	–	•	–	–	•	–
216-B-43 Crib	•	•	–	–	•	–	–	•	–
216-B-44 Crib	•	•	–	–	•	–	–	•	–
216-B-45 Crib	•	•	–	–	•	–	–	•	–
216-B-46 Crib	•	•	–	–	•	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
216-B-47 Crib	•	•	–	–	•	–	–	•	–
216-B-48 Crib	•	•	–	–	•	–	–	•	–
216-B-49 Crib	•	•	–	–	•	–	–	•	–
216-B-50 Crib	•	•	–	–	•	–	–	•	–
216-B-55 Crib	•	•	–	–	•	–	–	•	–
216-B-56 Crib	–	–	–	–	–	–	–	–	–
216-B-57 Crib	•	•	–	–	•	–	–	•	–
216-B-60 Crib	–	•	–	–	–	–	–	•	–
216-B-61 Crib	–	•	–	–	–	–	–	•	–
216-B-62 Crib	•	•	–	–	•	–	–	•	–
CTF N. of 2703-E	•	–	–	•	•	–	–	•	–
216-B-13 French Drain	–	•	–	–	–	–	–	•	–
216-B-51 French Drain	–	•	–	–	•	–	–	•	–
Reverse Wells									
216-B-4 Reverse Well	–	•	–	–	–	–	–	•	–
216-B-5 Reverse Well	•	•	–	–	•	–	–	•	–
216-B-6 Reverse Well	–	•	–	–	–	–	–	•	–
216-B-11A Reverse Well	•	•	–	–	•	–	–	•	–
216-B-11B Reverse Well	•	•	–	–	•	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
Ponds, Ditches, and Trenches									
216-B-3 Pond	•	•	–	–	–	–	•	•	–
216-B-3A Pond	•	•	–	–	–	–	•	•	–
216-B-3B Pond	•	•	–	–	–	–	–	•	–
216-B-3C Pond	•	•	–	–	–	–	•	•	–
216-A-25 Pond	•	•	–	–	–	–	–	•	–
216-E-28 Pond	–	–	–	–	–	–	–	–	–
216-N-8 Pond	–	•	–	–	–	–	•	•	–
216-B-2-1 Ditch	•	•	–	–	•	–	–	•	–
216-B-2-2 Ditch	•	•	–	–	•	–	–	•	–
216-B-2-3 Ditch	•	•	–	–	•	–	–	•	–
216-B-3-1 Ditch	•	•	–	–	•	–	–	•	–
216-B-3-2 Ditch	•	•	–	–	•	–	–	•	–
216-B-3-3 Ditch	•	•	–	–	–	–	•	•	–
216-B-63 Trench	•	•	–	–	–	–	•	•	–
216-B-20 Trench	•	•	–	–	•	–	–	•	–
216-B-21 Trench	•	•	–	–	•	–	–	•	–
216-B-22 Trench	•	•	–	–	•	–	–	•	–
216-B-23 Trench	•	•	–	–	•	–	–	•	–
216-B-24 Trench	•	•	–	–	•	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
216-B-25 Trench	•	•	–	–	•	–	–	•	–
216-B-26 Trench	•	•	–	–	•	–	–	•	–
216-B-27 Trench	•	•	–	–	•	–	–	•	–
216-B-28 Trench	•	•	–	–	•	–	–	•	–
216-B-29 Trench	•	•	•	–	•	–	–	•	–
216-B-30 Trench	•	•	–	–	•	–	–	•	–
216-B-31 Trench	•	•	–	–	•	–	–	•	–
216-B-32 Trench	•	•	–	–	•	–	–	•	–
216-B-33 Trench	•	•	–	–	•	–	–	•	–
216-B-34 Trench	•	•	–	–	•	–	–	•	–
216-B-35 Trench	–	•	–	–	•	–	–	•	–
216-B-36 Trench	–	•	–	–	•	–	–	•	–
216-B-37 Trench	–	•	–	–	•	–	–	•	–
216-B-38 Trench	–	•	–	–	•	–	–	•	–
216-B-39 Trench	–	•	–	–	•	–	–	•	–
216-B-40 Trench	–	•	–	–	•	–	–	•	–
216-B-41 Trench	–	•	–	–	•	–	–	•	–
216-B-42 Trench	–	•	–	–	•	–	–	•	–
216-B-52 Trench	•	•	–	–	•	–	–	•	–
216-B-53A Trench	•	•	•	–	•	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
216-B-53B Trench	•	•	–	–	•	–	–	•	–
216-B-54 Trench	•	•	–	–	•	–	–	•	–
216-B-58 Trench	•	•	–	–	•	–	–	•	–
Septic Tanks and Associated Drain Fields									
2607-E1 Septic Tank	–	•	–	–	–	–	–	•	–
2607-E2 Septic Tank	–	•	–	–	–	–	–	•	–
2607-E3 Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-E4 Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-E7B Septic Tank	–	•	–	–	–	–	–	•	–
2607-E8 Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-E9 Septic Tank	–	•	–	–	–	–	–	•	–
2607-E11 Septic Tank	–	•	–	–	–	–	–	•	–
2607-EB Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-EH Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-EK Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-EM Septic Tank	–	•	–	–	–	–	–	•	–
2607-EN Septic Tank	–	•	–	–	–	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
2607-EO Septic Tank	–	•	–	–	–	–	–	•	–
2607-EP Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-EQ Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
2607-ER Septic Tank	–	•	–	–	–	–	–	•	–
2607-GF Septic Tank/Drain Field	–	•	–	–	–	–	–	•	–
Basins									
207-B Retention Basin	•	–	–	–	–	–	•	•	–
216-B-59B Retention Basin	–	•	–	–	–	–	•	•	–
216-B-64 Retention Basin	•	–	–	–	–	–	–	–	–
Burial Sites									
218-E-2 Burial Ground	•	–	•	–	•	–	–	•	–
218-E-2A Burial Ground	•	–	•	–	–	–	–	–	–
218-E-3 Burial Ground	•	–	–	–	–	–	–	–	–
218-E-4 Burial Ground	•	–	•	–	•	–	–	•	–
218-E-5 Burial Ground	•	–	•	–	•	–	–	•	–
218-E-5A Burial Ground	•	–	•	–	•	–	–	•	–
218-E-6 Burial Ground	–	–	–	–	–	–	–	–	–
218-E-7 Burial Ground	•	–	–	–	•	–	–	•	–

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

	Source Investigation Method								
Waste Management Unit	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
218-E-9 Burial Ground	•	—	•	—	•	—	—	•	—
200 Area Construction Pit	•	—	—	—	—	—	—	—	—
Unplanned Releases									
UN-200-E-7	•	—	—	—	•	—	—	•	—
UN-200-E-9	•	—	—	—	•	—	—	•	—
UN-200-E-14	•	—	—	—	•	—	—	—	—
UN-200-E-41	•	—	—	—	—	—	—	—	—
UN-200-E-43	•		—	—	•	—	—	—	—
UN-200-E-44	•	—	—	—	•	—	—	•	—
UN-200-E-52	•	—	—	—	—	—	—	•	—
UN-200-E-54	•	—	—	—	—	—	—	—	—
UN-200-E-55	•	—	—	—	—	—	—	—	—
UN-200-E-61	•	—	—	—	—	—	—	—	—
UN-200-E-63	•	—	—	—	—	—	—	—	—
UN-200-E-64	•	—	—	—	•	—	—	—	—
UN-200-E-69	•	—	—	—	•	—	—	—	—
UN-200-E-79	•	•	—	—	•	—	—	•	—
UN-200-E-80	•	—	—	—	•	—	—	•	—
UN-200-E-83	•	—	—	—	—	—	—	—	—
UN-200-E-87	•	—	—	—	•	—	—	•	—

Table 8-6. Applicable Characterization Investigation Methods at B Plant Aggregate Area Waste Management Units.

Waste Management Unit	Source Investigation Method								
	Surface Radiation Survey	Subsurface Spectral Geophysics	Surface Geophysics	Soil Gas Survey	Surface Soil Sampling	Wipe Samples	Surface Water Sediment Sampling	Subsurface Soil Sampling	Remarks
UN-200-E-90	•	–	–	–	•	–	–	–	–
UN-200-E-92	•	–	–	–	–	–	–	–	–
UN-200-E-95	•	–	–	–	•	–	–	–	–
UN-200-E-101	•	–	–	–	•	–	–	–	–
UN-200-E-103	•	–	–	–	•	–	–	–	–
UN-200-E-112	•	–	–	–	–	–	–	–	–
UN-200-E-140		–	–	•	•	–	–	–	–
UPR-200-E-4	•	–	–	–	•	–	–	•	–
UPR-200-E-32	•	•	–	–	•	–	–	•	–
UPR-200-E-34	•	•	–	–	•	–	–	•	–
UPR-200-E-51	•	–	–	–	•	–	–	–	–
UPR-200-E-84	•	–	–	–	•	–	–	•	–
UPR-200-E-138	•	•	–	–	•	–	–	•	–

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9.0 RECOMMENDATIONS

The purpose of the aggregate area management study (AAMS) is to compile and evaluate the existing body of knowledge to support the *Hanford Site Past-Practice Strategy* (DOE/RL 1992a) decision making process. A primary task in achieving this purpose is to assess each waste management unit and unplanned release within the aggregate area to determine the most expeditious path for remediation within the statutory requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA). The existing body of pertinent knowledge regarding the B Plant Aggregate Area waste management units and unplanned releases has been summarized and evaluated in the previous sections of this study. A data evaluation process has been established that uses the existing data to develop preliminary recommendations on the appropriate remediation path for each site. This data evaluation process is a refinement of the *Hanford Site Past-Practice Strategy* (Figure 1-2) and establishes criteria for selecting appropriate *Hanford Site Past-Practice Strategy* paths (expedited response action, ERA; interim remedial measures, IRM; limited field investigation, LFI; and final remedy selection) for individual waste management units and unplanned releases within the 200 Areas. A discussion of the criteria for path selection and the results of the data evaluation process are provided in Sections 9.1. and 9.2, respectively. Figure 9-1 provides a flowchart of the data evaluation process that will be discussed. Table 9-1 provides a summary of the results of data evaluation assessment of each unit. Table 9-2 provides the decision matrix patterns which each unit followed.

This section presents recommended assessment paths for the waste management units and unplanned releases at the B Plant Aggregate Area. These recommendations are only proposed at this time and are subject to adjustment and change. Factors that may affect development of final recommendations include, but are not limited to, comments and advice from the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), or U.S. Department of Energy (DOE); identification and development of new information; and modification of the criteria used in the assessment path decision making process. Changes in recommendations will be addressed, and more detail on recommended assessment paths for waste management units and unplanned releases will be included in work plans as they are developed for the actual investigation and remediation activities.

The data evaluation process depicted in Figure 9-1 and discussed in Section 9.1 was developed to facilitate only the technical data evaluation step shown on the *Hanford Site Past-Practice Strategy* (Figure 1-2). Procedural and administrative requirements to implement the recommendations provided in this AAMS will be performed in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1990) and the *Hanford Site Past-Practice Strategy.*

A majority of waste management units and unplanned releases do not have information regarding the nature and extent of contamination necessary for quantitative or qualitative risk assessment, especially with regard to hazardous constituents, and were recommended for additional investigation (e.g., LFI). One unit, the 216-B-5 Reverse Well, was recommended for an ERA to assess whether the liquid waste discharged into the groundwater could present time critical migration problems. Several units and releases assessed within the ERA path were recommended for actions that fall within the scope of existing operational programs. Wooden cribs and other waste management units with collapse potential as well as sites with elevated levels of surface radionuclide contamination are addressed by the Radiation Area Remedial Action (RARA) program.

Waste management units and unplanned releases which are addressed entirely by other programs were not subjected to the data evaluation process. This includes units and unplanned releases which are within the scope of the Single-Shell Tank Program, Surplus Facilities Program, and Defense Waste Management Program.

A majority of facilities not addressed in the data evaluation fall within the scope of the Single-Shell Tank Program. The activities associated with the closure of the 200-BP-7 Operable Unit single-shell tank sites have separate *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) milestones and any recommendations for disposition of these units and associated unplanned releases will be developed as part of the ongoing program addressing the single-shell tanks. The units associated with the 241-B, -BX and -BY Tank Farms that were not evaluated include single-shell tanks and associated diversion boxes, catch tanks, and high-level waste transfer lines (Table 9-3).

A discussion of the four decision-making paths shown on Figure 9-1: ERA, IRM, LFI, and final remedy selection, is provided in Section 9.1. Section 9.2 provides a discussion of the waste management units grouped under each of these paths. A discussion of regrouping and prioritization of the waste management units is provided in Section 9.3. Recommendations for redefining operable unit boundaries and prioritizing operable units for work plan development are also provided in Section 9.3. No additional aggregate area-based field characterization activities are recommended to be undertaken as a continuation of the AAMS. All recommendation for future characterization needs (see Section 8.0) will be more fully developed and implemented through work plans. Plan development and submittal will be accomplished in accordance with requirements of the *Hanford Site Past-Practice Strategy* and the Tri-Party Agreement (Ecology et al. 1990) and could include remedial investigation (RI)/feasibility study (FS) (RCRA Facility Investigation [RFI]/Corrective Measures Study

[CMS]) work plans. Sections 9.4 and 9.5 provide recommendations for focused feasibility and treatability studies, respectively.

9.1 DECISION MAKING CRITERIA

The criteria used to assess the most expeditious remediation process path are based primarily on urgency for action and whether site data are adequate to proceed along a given path (Figure 9-1). All waste management units and unplanned releases that are not completely addressed under other Hanford Site programs are assessed in the data evaluation process. All of the units and releases that are addressed in the data evaluation process are initially evaluated as candidates for an ERA. Sites where a release has occurred or is imminent are considered candidates for ERAs. Conditions that might trigger an ERA are the determination of an unacceptable health or environmental risk or a short time-frame available to mitigate the problem (DOE/RL 1992a). As a result, candidate ERA units were evaluated against a set of criteria to determine whether potential for exposure to unacceptable health or environmental risks exist. Waste management units and unplanned releases that are recommended for ERAs will undergo a formal evaluation following the selection process outlined in *Prioritizing Sites for Expedited Response Actions at the Hanford Site* (WHC 1991b).

Waste management units and unplanned releases that are not recommended for consideration as an ERA continue through the data evaluation process. Sites continuing through the process that potentially pose a high risk (refer to Section 5.0), become candidates for consideration as an IRM. The criteria used to determine a potential for high risk, thereby indicating a high priority site, were the Hazard Ranking System (HRS) score used for nominating waste management units for CERCLA cleanup (40 CFR 300), the modified Hazard Ranking System (mHRS) scores, surface radiation survey data, and rankings by the Environmental Protection Program. Units and unplanned releases with HRS or mHRS scores greater than 28.5 (the CERCLA cleanup criterion) were designated as candidate sites for IRM consideration. Units and unplanned releases that did not have an HRS score were compared to similar sites to establish an estimated HRS score. Sites with surface contamination greater than 2 mR/h exposure rate, 100 ct/min beta/gamma above background or alpha greater than 20 ct/min were also designated as candidate IRM sites. In addition, surface contamination sites that had an Environmental Protection Program ranking of greater than 7 were also designated as candidate IRM sites.

The candidate IRM sites are listed in Table 5-1, which summarizes the high priority sites. The four risk indicators are based on limited data (see Section 8.0) and, therefore, may not adequately represent the actual risk posed by the site. Technical judgment, including assessment of similarities in site operational histories, was used to include sites not ranked as high priority in the list of sites under consideration for an IRM. Candidate IRM sites were then further evaluated to determine if an IRM is appropriate for the site. Candidate IRM sites that did not meet the IRM criteria were placed into the final remedy selection path. As future data become available the list of units recommended for consideration as IRM sites may be altered.

For certain waste management units and unplanned releases, it was recognized that remedial actions could be undertaken under an existing operational or other Hanford Site program (e.g., Single-Shell Tank, RARA, or Surplus Facility programs). As a result, recommendations were made that remedial actions be undertaken (partially or completely) outside the 200 AAMS past practice program. Units or unplanned releases that could be addressed only in part by another program (e.g., surface contamination cleanup under the RARA program) remained in the 200 AAMS data evaluation process for further consideration. If it cannot be demonstrated that these sites will be addressed under the operational program within a time frame compatible with the past practice program, they will be readdressed by the 200 AAMS process.

Units and unplanned releases recommended for complete disposition under another program (e.g., single-shell tanks and associated structures under the Single-Shell Tank Program) were not considered in the 200 AAMS data evaluation process.

Specific criteria used to develop initial recommendation for ERA, LFI, and IRM for units and unplanned releases within the aggregate area are provided in Sections 9.1.1 and 9.1.2. Units and unplanned releases not initially addressed as an ERA, LFI or IRM will be evaluated under the final remedy selection path discussed in Section 9.1.3.

9.1.1 Expedited Response Action Path

Candidate ERA sites are evaluated to determine if they pose an unacceptable health or environmental risk and a short time-frame to mitigate the problem exists. All waste management units and unplanned releases other than those recommended for complete disposition under another Hanford program are assessed against the ERA criteria. The *Hanford Site Past-Practice Strategy* describes conditions that might trigger abatement actions for a candidate waste management unit or unplanned release under an ERA. Generally, these conditions would rely on a determination of, or suspected, existing or future unacceptable health or environmental risk, and a short time-frame available to mitigate the problem. Conditions include, but are not limited to:

- Actual or potential exposure to nearby human populations, biota, or the food chain from hazardous substances and radioactive or mixed waste contaminants

- Actual or potential contamination of drinking water supplies or sensitive ecosystems

- Threats of release of hazardous substances and radioactive or mixed waste contaminants

- High levels of hazardous substances and radioactive or mixed waste contaminants in soils that pose or may pose a threat to human health or the environment, or have the potential for migration

- Weather conditions that may increase potential for release or migration of hazardous substances and radioactive or mixed waste contaminants

- The availability of other appropriate federal or state response mechanisms to respond to the release

- Time required to develop and implement a final remedy

- Further degradation of the medium which may occur if a response action is not expeditiously initiated

- Risks of fire or explosion or potential for exposure as a result of an accident or failure of a container or handling system

- Other situations or factors that may pose threats to human health or welfare or the environment.

These conditions were used as the initial screening criteria to identify candidate waste management units and unplanned releases for an ERA. Candidate waste management units and releases that did not meet these conditions were not assessed through the ERA evaluation path. Additional criteria for further, detailed screening of ERA candidates were developed based on the conditions outlined in the *Hanford Site Past-Practice Strategy*. Quantification of the criteria for further screening were developed. These additional screening criteria are shown in Figure 9-1 and are described below.

The next decision point on Figure 9-1 used to assess each ERA candidate is whether a driving force to an exposure pathway exists or is likely to exist. Units or unplanned releases with contamination that is migrating or is likely to significantly migrate to a medium that can result in exposure and harm to humans required additional assessment under the ERA process. Waste management units or unplanned releases where contamination could migrate and, therefore, potentially require significantly more extensive remedial action if left unabated were also assessed in the ERA path.

Waste management units and unplanned releases with a driving force were assessed to determine if an unacceptable health or environmental risk and a short time-frame to mitigate the problem exists from the release. The criteria used to determine unacceptable risks are based on the quantity and concentration of the release. If the release or imminent release is greater than 100 times the CERCLA reportable quantity for any constituent, the unit or unplanned release will remain in consideration for an ERA. If the release or imminent release contains hazardous constituents at concentrations that are 100 times the most applicable standard, the unit or unplanned release continues to be considered for an ERA. Application of the criterion of 100 times applicable standards is for quantification of the *Hanford Site Past-Practice Strategy* criteria which addresses "high levels of hazardous substances and radioactive or mixed waste contaminants...." The factor of 100 is based on engineering judgment of what constitutes a high level of contamination warranting expedited action. In some cases, engineering judgment was used to estimate the quantity and concentration of a postulated release. Standards applied include Model Toxics Control Act (MTCA) standards for industrial sites and DOE and Westinghouse Hanford radiation criteria (refer to Section 6.0). The application of these standards does not signify they are recognized as ARARs.

The ERA screening criteria, in addition to those presented in the *Hanford Site Past-Practice Strategy* were applied to provide a consistent quantitative basis for making recommendations in the AAMS. The decision to implement the recommendations developed in AAMS will be made collectively between DOE, EPA, and Ecology based only on the criteria established in the *Hanford Site Past-Practice Strategy*.

If a release is unacceptable with respect to health or environmental risk, a technology must be readily available to control the release for a unit or unplanned release to be considered for an ERA. An example that would require substantial technology development before implementation of cleanup would be a tritium release since no established treatment technology is available to separate low concentrations of tritium from water.

The next step in the ERA evaluation path involves determining whether implementation of the available technology would have adverse consequences that would offset the benefits of an ERA. Examples of adverse consequences include: (1) use of technologies that result in risks to cleanup personnel that are much greater than the risks of the release; (2) the ERA would foreclose future remedial actions; and (3) the ERA would prevent or greatly hinder future data collection activities. If adverse consequences are not expected, the site remains in consideration for an ERA.

The final criterion is to determine if the candidate ERA is within the scope of an operational program. Maintenance and operation of active waste management facilities are within the scope of activities administered by the Defense Waste Management Program. Active facilities include certain transfer lines, diversion boxes, and catch tanks. Generally, active facilities will not be included in past practice investigations unless operation is discontinued prior to initiation of the investigation. The Surplus Facilities and RCRA Closure programs are responsible for safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and RCRA closures at the Hanford Site. The Surplus Facilities program is also responsible for RARA activities that include surveillance, maintenance, decontamination, and/or stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites.

If the proposed ERA will not address all the contamination present, the unit or unplanned release continues through the process to be evaluated under a second path. For example, surface contamination cleanup under the RARA program may not address subsurface contamination and, therefore, additional investigation may be needed.

Final decisions regarding whether ERAs are justified in the aggregate area will be made among the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington Department of Ecology (Ecology) based, at least in part, on the recommendations provided in this section, and results of the final selection process outlined in *Prioritizing Sites for Expedited Response Actions at the Hanford Site* (WHC 1991b).

9.1.2 Limited Field Investigation and Interim Remedial Measure Path

High priority waste management units and unplanned release sites were evaluated to determine if sufficient need and information exists such that an IRM could be pursued. An IRM is desired for high priority waste management units and unplanned releases where extensive characterization is not necessary to reach defensible cleanup decisions. Implementation of IRMs at waste management units and unplanned releases with minimal characterization is expected to rely on observational data acquired during remedial activities. Successful execution of this strategy is expected to reduce both time and cost for cleanup of waste management units and unplanned releases without impacting the effectiveness of the implemented action.

The initial step in the IRM evaluation path is to categorize the units. The exposure pathways of interest are similar for each site in a category; therefore, it is effective to evaluate candidate waste management units as a group. The groupings used in Section 2.3 (e.g., cribs; tanks and vaults; etc.) will continue to be used to group the waste management units for IRM assessment. This grouping approach is especially effective in reducing characterization requirements. As is being done in the 100 areas using the observational approach, the LFIs can be used to characterize a representative unit or units in detail to develop a remedial alternative for the group of waste management units. Observational data obtained during implementation of the remedial alternative could be used to meet unit specific needs. Similarities of waste management units may make it possible to remediate them using the observational approach after first characterizing only a few units. It is expected, therefore, that a LFI would provide sufficient information to proceed with an IRM for groups of similar high priority waste management units.

Data adequacy is assessed in the next step. The existing data are evaluated to determine if: (1) existing data were sufficient to develop a conceptual model and qualitative risk assessment; (2) the IRM will work for this path; (3) implementing the IRM will have adverse impacts on the environment, future remediation activities or data collection efforts; (4) the benefits of implementing the IRM are greater than the costs. If data are not adequate an assessment was made to determine if an LFI might provide enough data to determine if an IRM is justified, and also to perform an IRM. If an LFI would not collect sufficient data, the unit was addressed in the final remedy selection path.

The final step in the IRM evaluation process is to assess if the IRM will work without significant adverse consequences. This includes: will the IRM be successful? will it create significant adverse environmental impacts (e.g., environmental releases)? will the costs outweigh the benefits? will it preclude future cleanup or data collection efforts? and will the risks of the cleanup be greater than the risks of no action? Units where remediation is considered to be possible without adverse consequences outweighing the benefits of the remediation are recommended for IRMs.

Final decisions will be made between DOE, EPA, and Ecology on whether particular IRMs are justified based, at least in part, on the recommendation provided in this AAMSR, and the results of a supporting LFI.

9.1.3 Final Remedy Selection Path

Sites recommended for initial consideration in the final remedy selection path are those not recommended for IRMs, LFIs, or ERAs and those considered to be low priority sites. It is recognized that all waste management units and unplanned releases within the operable unit or aggregate area will eventually be addressed collectively under the final remedy path to support a final Record of Decision (ROD).

The initial step in the final remedy selection process path is to assess whether the combined data from the AAMS, and any completed ERAs, IRMs, and LFIs are adequate for performing a risk assessment (RA) and selecting a final remedy. Whereas the scope of an ERA, IRM, and LFI is limited to individual waste management units or groups of similar waste management units, the final remedy selection path will likely address an entire operable unit or aggregate area.

If the data are collectively sufficient, an operable unit or aggregate area RA will be performed. If sufficient data are not available, additional needs will be identified and collected.

9.2 PATH RECOMMENDATIONS

Initial recommendations for ERA, IRM, and LFI are discussed in Section 9.2.1 through 9.2.3, respectively. Waste management units and unplanned releases proposed for initial consideration under the final remedy selection path are discussed in Section 9.2.4. Table 9-1 provides a summary of the data evaluation process path assessment. A summary of the responses to the decision points on the flowchart that led to the recommendations is provided in Table 9-2. A listing of sites that will be addressed by other operational programs is presented in Table 9-3. Ten waste management units lie within the 200-BP-1 Operable Unit and are not evaluated because work is already in progress under the 200-BP-1 RI/FS Work Plan. These waste management units are the 216-B-43 through 216-B-50 Cribs, the 216-B-57 Crib, and the 216-B-61 Crib. Following approval by DOE, EPA, and Ecology, these recommendations will be further developed and implemented in work plans.

9.2.1 Proposed Sites for Expedited Response Actions

Forty-nine waste management units and unplanned releases meet all the criteria for an ERA prior to determining whether the proposed action was within the scope of an operational program. One unit, the 216-B-5 Reverse Well, was recommended for an ERA. Forty-eight candidate ERA units (sites with collapse potential and surface contamination sites) were recommended for disposition under the RARA program. Ten active waste management units receiving liquid discharges were evaluated as candidate ERA units. The active units are within the scope of an ongoing Defense Waste Management program to discontinue discharges from liquid effluent to the soil column. A discussion of the recommendations for these waste management units are included in this section. Since the anticipated response actions are not expected to fully remediate the ERA candidates, all of the units will be included for further data evaluation in the assessment paths.

9.2.1.1 Cribs and Trenches with Collapse Potential. Thirteen of the older cribs are open wooden structures that could fail catastrophically. Two cribs, 216-B-18 and 216-B-12, have already collapsed. Also, sixteen specific retention trenches, two reverse wells, and one burial ground contain wooden structures that could collapse. A sudden collapse could bring contaminated dust from the buried crib, trench, or burial ground to the surface. Based on the inventory data from these units, dust derived from the bottom of the cribs, trenches, and burial ground would be expected to contain radionuclides at several orders of magnitude above reportable quantities and concentration standards. Cribs with potential collapse problems include:

- 216-B-14
- 216-B-15
- 216-B-16
- 216-B-17
- 216-B-18 (already collapsed)
- 216-B-19
- 216-B-7A
- 216-B-7B
- 216-B-8TF
- 216-B-9TF
- 216-B-10A
- 216-B-10B
- 216-B-12 (already collapsed).

Trenches with potential collapse problems include:

- 216-B-20
- 216-B-21
- 216-B-22
- 216-B-23
- 216-B-24
- 216-B-25
- 216-B-26
- 216-B-27
- 216-B-28
- 216-B-29
- 216-B-30
- 216-B-31
- 216-B-32
- 216-B-33
- 216-B-34
- 216-B-58.

The reverse wells with collapse potential are:

- 216-B-11A & 216-B-11B.

The burial ground with collapse potential is:

- 216-E-7.

Maintenance and contamination control measures for cribs, trenches, reverse wells, and burial grounds with collapse potential are implemented under the RARA program. Therefore, actions to mitigate environmental releases from these facilities will be performed under the RARA program. An engineering study is planned under the RARA program for 1993 to evaluate the potential for crib collapse.

Response actions such as the addition of clean fill material over the cribs or pressure grouting void areas within the crib to prevent collapse may be considered for these waste management units. Evaluation and recommendation of response actions for these facilities will be performed under the RARA program.

9.2.1.2 Active Waste Management Units. Eleven active liquid effluent units operate within the B Plant Aggregate Area; 207-B Retention Basin, 216-B-59 Retention Basin, 216-B-3-3 Ditch, 216-B-63 Ditch, 216-B-55 Crib, 216-B-62 Crib, 216-B-3 Pond, 216-B-3A Pond, 216-B-3B Pond, 216-B-3C Pond, and 2101-M Pond. Operation of these facilities provides a potential for migration of radioactive contaminants to the groundwater. Efforts are currently underway to evaluate an alternative that could be implemented that would result in deactivation of these facilities by June 1995. In the interim, hazardous wastes will not be discharged to these units. Evaluation and deactivation of these facilities will remain with the ongoing program and will not be included as part of the past practices investigation. In addition, investigation of contamination associated with the facilities will be deferred until after deactivation of the facilities.

9.2.1.3 Sites With Significant Surface Contamination. There are thirty-nine sites with levels of surface contamination that are high enough to be of immediate concern. Surface contamination is immediately accessible to humans (i.e., workers) and biota. The potential for transport by the wind or biota is also significant and so surface migration is also a problem. It is expected that the releases of radionuclides and potential radiation exposure levels at these sites would be greater than 100 times reportable quantities and quality standards. The corrective actions for these surface contamination sites is addressed within the scope of the RARA program.

Surface contamination exists in areas around the 216-B-7AB, 216-B-8, and 216-B-55 Cribs as well as the 216-B-51 French Drain. This area includes unplanned releases. These areas are recommended for evaluation and stabilization under the RARA program.

The 216-B-2-2, 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches have surface contamination present in localized hot spots. These ditches are being stabilized under the interim stabilization plan (RARA program) (Hayward 1992).

Surface contamination exists in an area around the 216-B-20 through 216-B-34 and 216-B-53A through 216-B-54 Trenches. These areas are recommended for evaluation and implementation under the RARA program.

Surface contamination exists in an area west of the 216-B-64 Retention Basin. The 216-B-64 Retention Basin has never been used. The contamination present near it may be the result of leakage from the 270-E Tank. This site includes unplanned release UN-200-E-64. This site is recommended for evaluation and implementation under the RARA program.

The 218-E-2, 216-E-5, 216-E-5A, and 216-E-9 Burial Grounds have significant surface contamination present. These sites are being stabilized as part of the RARA program.

Surface contamination exists at the sites of five unplanned releases, UN-200-E-63, UN-200-E-83, UPR-200-E-32, UN-200-E95, and UPR-200-E-84. The unplanned release UN-200-E-83 covers a very large area of several square miles. These sites are recommended for evaluation and implementation under the RARA program.

9.2.1.4 Non-ERA Sites. The primary reason most waste management units were not recommended for ERAs was because of the lack of driving force to an exposure pathway. Inactive cribs, ponds, ditches, and trenches are no longer receiving waste and, therefore, no longer have artificial recharge as a driving force to move subsurface contaminants. Natural recharge from local precipitation was not considered a significant short-term driving force. Specifics for each waste management unit or unplanned release are provided in Table 9-2.

9.2.2 Proposed Sites for Interim Remedial Measures

Forty-three of the 129 waste management units and unplanned releases addressed in the B Plant Aggregate Area data evaluation process were identified as high priority waste management units (refer to section 5.0) and were assessed as candidates for IRMs. Eleven of the 43 waste management units were designated as high priority waste management units and unplanned releases because of high HRS and mHRS scores. Fifteen of the other waste management units and unplanned releases were designated as high priority because of surface radiation measurements. The Environmental Protection rankings did not add to the high priority sites because they had been included on the list because of the other criteria. Seventeen of the forty-three waste management units did not have high HRS of mHRS scores or surface contamination but were included on the list because of their similarity to other units, which were high priority units. Septic tanks and drain fields were not considered in the IRM path.

All of the 43 candidate IRM waste management units or releases met the criteria for IRM designation with the exception of having adequate data. It was determined that an LFI could gather sufficient data for an IRM, therefore all of the sites remain IRM candidates. A discussion of the LFIs is provided in Section 9.2.3.

9.2.3 Proposed Sites for Limited Field Investigation Activities

Fifty-three waste management units are recommended to undergo LFIs. Five additional unplanned releases and one trench are also included in the LFI group because of their association with LFI sites. The rationale for IRM and LFI will be more completely developed in work plans, however, the following addresses possible considerations during work plan development.

Possible LFI objectives would be to:

- Evaluate the potential for releases from the waste management unit to impact underlying groundwater quality.
- Determine if contamination exists in the soil beneath the waste management unit and, if so, assess the extent.
- Assess the nature and extent of contaminant migration from the units in support of focused feasibility studies.

Candidate IRM waste management units have been identified for six of the ten group categories listed in Section 2.0. Sites falling under these categories are discussed below.

9.2.3.1 Crib and Drains. Fourteen cribs and drains were recommended for LFIs. These sites were all considered high priority but lack sufficient information to conduct an IRM. Eleven of the cribs and drains were considered high priority based on HRS scores and three due to surface radiation.

Thirteen of the cribs with collapse potential will be addressed under the RARA Program (Section 9.2.1). The actions implemented under the RARA Program will precede the LFI activities. Cribs recommended for the RARA program include the following:

- 216-B-7A
- 216-B-7B
- 216-B-8TF
- 216-B-9TF
- 216-B-10A
- 216-B-10B
- 216-B-12 (collapsed)
- 216-B-14
- 216-B-15
- 216-B-16
- 216-B-17
- 216-B-18 (collapsed)
- 216-B-19.

The cribs with surface contamination were addressed in the IRM path after first being assessed in the ERA path. The actions recommended for the units will not address the subsurface contaminations in the facilities; therefore, they were included for assessment under the remaining criteria.

9.2.3.2 Reverse Wells. Four of the five reverse wells located in the B Plant Aggregate Area have been recommended for LFIs. These wells were considered high priority due to HRS scores but lacked sufficient information to conduct IRMs. An ERA was recommended for the fifth reverse well, 216-B-5.

The 216-B-11A and 216-B-11B Reverse Wells were identified as having collapse potential based on the most recent radiological survey. These wells will be addressed under the RARA program (Section 9.2.1). The actions implemented under the RARA program will precede the LFI activities.

The reverse wells recommended for LFIs are the following:

- 216-B-4 Reverse Well
- 216-B-6 Reverse Well
- 216-B-11A Reverse Well

- 216-B-11B Reverse Well.

Four of the reverse wells were addressed in the IRM path after first being assessed in the ERA path. These waste management units were not recommended for an ERA due to the lack of concentration greater than one-hundred times standards or the availability of operational programs.

9.2.3.3 Ponds, Ditches, and Trenches. Four ponds, six ditches, and one trench have been recommended for LFIs. These units have insufficient data to conduct an IRM and have been recommended for additional characterization. The units are listed below.

- 216-B-3 Pond
- 216-B-3A Pond
- 216-B-2-1 Ditch
- 216-B-2-2 Ditch
- 216-B-2-3 Ditch
- 216-B-3B Pond
- 216-B-3C Pond
- 216-B-3-1 Ditch
- 216-B-3-2 Ditch
- 216-B-3-3 Ditch
- 216-B-63 Trench

The ponds have been included due to the releases that have been introduced into the pond system and the lack of data to differentiate the individual units. All were assessed under the ERA path but were not selected due to the reportable quantity criteria or because they were covered under operational programs.

The ditches 216-B-2-1 through 216-B-2-3 have all been included because of surface contamination and are to be included under the RARA Program activities (Section 9.2.1). The RARA activities will precede LFI action. The 216-B-3-1 through 216-B-3-3 Ditches are included because of their similarity to the 216-B-2 Ditches. The 216-B-63 Ditch is included because of its close proximity to the 216-B-2-1 Ditch.

9.2.3.4 Retention Basins. Two retention basins located in the B Plant Aggregate Area have been recommended for LFIs. The two units are 207-B Retention Basin and 216-B-64 Retention Basin and both were cited for inclusion as an LFI due to surface contamination. Both were evaluated on the ERA path. The 207B Retention Basin was eliminated from consideration due to quantity consideration. The 216-B-64 Retention Basin 216-B-64 is recommended for Operational Programs status as a RARA program site. This waste management unit is associated with the UN-200-E-64 unplanned release.

9.2.3.5 Burial Grounds. A total of five burial grounds are recommended for LFIs. These include the following:

- 218-E-2
- 218-E-4
- 218-E-5
- 218-E-5A
- 218-E-9.

All five burial grounds were considered high priority due to surface contamination but all lacked sufficient information to determine if an IRM is justified.

9.2.3.6 Unplanned Releases. Fourteen unplanned releases are suggested for LFI status. Five are included due to surface radiation and the remainder are included due to their history of proximity to other LFI sites. The fourteen are listed below.

- UN-200-E-41
- UPR-200-E-32
- UN-200-E-43
- UN-200-E-44
- UN-200-E-63
- UN-200-E-64
- UN-200-E-69
- UN-200-E-103
- UN-200-E-52
- UPR-200-E-138
- UN-200-E-80
- UN-200-E-83
- UPR-200-E-84
- UN-200-E-90
- UN-200-E-95.

9.2.4 Proposed Sites for Final Remedy Selection

A number of unplanned releases, along with several diverse waste management units which are unique because of design, contaminants received, or operational history, have been proposed for the final remedy selection path. No sites have been proposed for direct inclusion in the final remedy risk assessment. Direct inclusion in the final remedy selection RI is recommended for the remainder of the waste management units and unplanned releases due to the lack of information to perform RAs and select final remedies. These waste management units and unplanned releases are discussed in Section 9.2.4.1.

Ten waste management units are in the 200-BP-1 Operable Unit. Work is in progress in this operable unit under the 200-BP-1 RI/RS Work Plan. These waste management units will not be discussed further.

9.2.4.1 Proposed Sites for Remedial Investigation. A RI has been recommended for the B Plant Aggregate Area, which includes several groups of waste management units and unplanned releases. The first group generally contains a mix of unique units that were assessed in the IRM path but had insufficient data to conduct an IRM. The second group consists of low priority trenches (dry trenches) that generally received one time transfers of waste and cribs, ditches, ponds and french drains that did not meet the high priority criteria. The third group contains septic tanks and drain fields that require confirmatory sampling to show that the sites do not contain hazardous or radioactive substances. The fourth group contains burial sites that require confirmatory sampling to show no contamination exists. The fifth group contains low priority unplanned releases that have unique contamination histories.

The waste management units and unplanned releases recommended for RI from the final remedy selection path are all low priority sites.

9.2.4.1.1 Retention Basin and Settling Tank. The two waste management units within this group were assessed in the IRM path prior to designation as final remedy sites. The sites include:

- 241-B-361 Settling Tank
- 216-B-59B Retention Basin.

The settling tank was assigned a low HRS score and is not sufficiently similar to high priority units to warrant evaluation under the IRM path, so it could not be recommended for a LFI.

The retention basin is currently an operational unit and no unplanned releases have been associated with it. It was originally constructed as a crib and received a small quantity of waste early in its operational history prior to conversion to a retention basin.

Insufficient data exists at these sites to conduct a RA. A RI is recommended that would include each of these sites to provide nature and extent of contamination information to perform a risk assessment for final remedy selection.

9.2.4.1.2 Ponds, Ditches, Trenches, Cribs, and French Drains. Ponds, ditches, trenches, cribs, and french drains are grouped as a single class because of their similarity. These waste management units were all designed to dispose of wastewater by discharging it to the soil column in a relatively shallow excavation. The water entered the soil column through the bottom of the excavated area and penetrated the soil column. The contaminants were either contained within the excavation or passed into the soil column and are suspended in the soil column below the waste management unit. Sixteen of these sites are recommended for inclusion in the RARA program due to their collapse potential before RI initiation. The waste management units included in this group are:

- 216-B-55 Crib
- 216-B-56 Crib
- 216-B-60 Crib
- 216-B-62 Crib
- CTF North of 2703-E
- 216-B-13 French Drain
- 216-A-25 Pond
- 216-E-28 Contingency Pond
- 216-N-8 Pond
- 216-B-20 Trench through 216-B-34 Trench (RARA)
- 216-B-35 Trench through 216-B-42 Trench
- 216-B-52 Trench
- 216-B-53A Trench (RARA)
- 216-B-53B Trench (RARA)
- 216-B-54 Trench (RARA)
- 216-B-58 Trench (RARA).

All of these waste management units are low priority units based on their HRS score. Insufficient data exists to determine the nature and extent of contamination at these sites. Therefore, a RI that includes each unit was recommended to provide data adequate to perform a RA and select a final remedy for the units.

9.2.4.1.3 Septic Tanks and Drain Fields. Confirmatory investigation levels should be performed at each of the septic tanks and drain fields:

- 2607-E1 Septic Tank
- 2607-E2 Septic Tank
- 2607-E3 Septic Tank/Drain Field
- 2607-E4 Septic Tank/Drain Field
- 2607-E7B Septic Tank
- 2607-E8 Septic Tank/Drain Field
- 2607-E9 Septic Tank
- 2607-E11 Septic Tank
- 2607-EB Septic Tank/Drain Field
- 2607-EH Septic Tank/Drain Field
- 2607-EK Septic Tank/Drain Field
- 2607-EM Septic Tank
- 2607-EN Septic Tank
- 2607-EO Septic Tank
- 2607-EP Septic Tank/Drain Field
- 2607-EQ Septic Tank/Drain Field
- 2607-ER Septic Tank
- 2607-GF Septic Tank/Drain Field.

These sites have all been assigned low HRS scores by comparison with other units. These sites were all used to dispose of sanitary waste and are considered unlikely to have chemical or radiological contamination present.

There are no sampling or inventory data for any of the sites and so a RA cannot be performed. The purpose of a limited sampling program is to confirm that no contamination exists in the tanks and drain fields. If no contamination were to be found, then no further action would likely be recommended.

9.2.4.1.4 Burial Grounds. Five burial grounds have been grouped together as a single class because of their similarity. The burial ground sites are:

- 218-E-2A Burial Ground
- 218-E-3 Burial Ground
- 218-E-6 Burial Ground

- 218-E-7 Burial Ground
- 200 Area Construction Pit.

Four burial ground sites were used to dispose of contaminated solid materials and contain subsurface radioactive contamination. Insufficient sampling and inventory data exists for these sites to perform a RA. Therefore, a RI that includes each unit was recommended to provide data adequate to perform a RA and select a final remedy for the units. The unique nature of the units will not allow for investigation of a representative unit and applying the information to the other sites.

Two sites, the 200 Area Construction Pit and the 218-E-2A Burial Ground, were not used to dispose of contaminated materials. Confirmatory investigation levels should be conducted at these sites. If no contamination were to be found, then no further action would likely be recommended.

9.2.4.1.5 Unplanned Releases. Seventeen unplanned releases with known contamination are candidates for inclusion in an aggregate area or operable unit RI. These sites are:

- UN-200-E-7
- UN-200-E-9
- UN-200-E-14
- UN-200-E-54
- UN-200-E-55
- UN-200-E-92
- UN-200-E-101
- UN-200-E-112
- UN-200-E-140
- UPR-200-E-140
- UPR-200-E-4
- UPR-200-E-34
- UPR-200-E-51
- UN-200-E-61
- UPR-200-E-79
- UN-200-E-87
- UPR-200-E-78

The unplanned releases all had low HRS scores and surface radiation levels and were classified as low priority. The low priority releases are assessed under the final remedy selection path. A lack of soil sample data and inconsistent or incomplete survey data make RA completion impossible. A RI needs to be performed to identify the contaminants and their extent.

9.3 SOURCE OPERABLE UNIT REDEFINITION AND PRIORITIZATION

The investigation process can be made more efficient if waste management units with similar histories and waste constituents are studied together. The data needs and remedial actions required for similar waste management units are generally the same. It is much easier to ensure a consistent level of effort and investigation methodology if like waste management units are grouped together. Economies of scale also make the investigation process more cost effective if similar waste management units are studied together.

9.3.1 Units Addressed by Other Aggregate Areas or Programs

The investigation of several sites in the B Plant Aggregate Area will be addressed by other programs for investigation. The programs include the Surplus Facilities Program, the Defense Waste Management Program, and Hanford Site Single-Shell Tank Program. Table 9-3 lists the waste management units and unplanned releases that are within the scope of these programs. No waste management units within the B Plant aggregate area are recommended for deferral to another aggregate area.

The waste management unit recommended for the Surplus Facilities Program include:

- 270-E Condensate Neutralization Tank.

Remediation of this unit can be most effectively addressed through decontamination and decommissioning efforts under the Surplus Facilities Program.

Many of the waste management units associated with the operation of the 241-B, 241-BX, and 241-BY Tank Farms are addressed by the Single-Shell Tank Closure Program. The units include all of the diversion boxes, catch tanks, receiving vaults, and associated process piping in the B Plant Aggregate Area as well as the unplanned releases that are located in the tank farms and associated with these waste management units.

Deactivation of active liquid effluent units should remain within the existing Defense Waste Management Program. The active liquid effluent facilities are listed in Table 9-1. Investigation of these facilities will be deferred until after deactivation.

9.3.2 B Plant Aggregate Area Operable Unit Redefinition

Redefinition of the B Plant Aggregate Area operable units is suggested based on the data evaluation in this report. General redefinition is recommended as follows:

- Investigation of groundwater should be removed from the scope and included in a 200 East Aggregate Area Groundwater operable unit. Groundwater beneath the B Plant Aggregate Area operable units interacts with all surrounding operable units since it is not confined by the geographic boundaries. Contamination from nearby operable units can migrate beneath any of the B Plant operable units. Similarly, the contamination originating from the operable unit may migrate outside the boundaries of the operable unit. These interactions with other operable units will necessitate the integration of groundwater response actions throughout the 200 East Area. This integration will be discussed in the 200 East Groundwater Aggregate Area Management Study.

- High-level waste transfer facilities and encased pipelines should remain within the scope of the Defense Waste Management Program and the Surplus Facilities Program. The facilities are also structures with no unplanned releases and can be dealt with more efficiently in these existing Hanford programs. The Tri-Party Agreement does not include these lines within the scope of the past-practices investigation.

- Waste management units fully addressed by other programs which should not be included in the aggregate area investigations (e.g., 2101-M Pond, active waste management units, etc.) are listed in Table 9-3.

Specific redefinition of the operable units are as follows:

- The 200-BP-8 Operable Unit should be combined into the 200-BP-11 Operable Unit. The 200-BP-8 Operable Unit contains similar waste management units to those of 200-BP-11 with interrelated process histories. The investigation of these waste management units associated with B Pond should be collectively addressed as one operable unit.

- The 216-A-29 Ditch in the 200-PO-5 Operable Unit in the PUREX Plant Aggregate Area should be reassigned to the 200-BP-11 Operable Unit. This waste management unit has a process history and contaminant inventory similar to the 216-B-3-3 Ditch and the 216-B-3 Pond System and is better investigated with those waste management units in the 200-BP-11 Operable Unit.

- The 200-BP-8 Designator Unit should be reassigned as a groundwater operable unit, the scope of which will be defined by the 200 East Groundwater AAMS.

9.3.3 Investigation Prioritization

Very little data exist to rank the waste management units and unplanned releases within the B Plant Aggregate Area on a risk-related basis. The HRS and surface contamination data that were used to sort the waste management units and unplanned releases into either high or low priority are indicators of potential risk but are not suitable to develop a risk-related ranking. The most useful data for indicating potential risk are probably the waste inventories and facility construction or operation information.

Based on inventories of contaminants intentionally discharged, the eight cribs located in the 200-BP-1 Operable Unit north of the 241-BY Tank Farm received the largest quantities of contamination. This has resulted in priority being given to 200-BP-1. A work plan has been approved for the 200-BP-1 Operable Unit and the RI Phase I field work is complete. Currently, the RI report is being prepared.

The RCRA closure activities are underway for the 200-BP-11 Operable Unit. Phase I and III sampling has been completed and further work will be initiated following approval of the 216-B-3 Pond Closure/Post Closure Plan. This activity must be scheduled so that Tri-Party Agreement milestone dates are met. This requires that the 200-BP-11 Operable Unit be prioritized ahead of the remaining operable units.

Two of the operable units, 200-BP-5 and 200-BP-4, contain waste management units which received relatively large inventories of plutonium. The 200-BP-5 Operable Unit contain the 216-B-5 Reverse Well that received plutonium contamination which may have entered groundwater. The 216-B-5 Reverse Well has been selected for an ERA. The remainder of the 200-BP-5 Operable Unit will be given a lower priority following completion of the ERA for the 216-B-5 Reverse Well. The 200-BP-4 Operable Unit contains the 216-B-7A and -7B Cribs which received a waste stream containing plutonium similar to that which discharged to the 216-B-5 Reverse Well. The plutonium inventory gives the 200-BP-4 Operable Unit the highest priority after 200-BP-11.

The 200-BP-2 and 200-BP-3 Operable Units contain specific retention trenches and cribs which received relatively large inventories of contaminants. An unplanned release from the 200-BP-2 Operable Unit has covered a large area south of the operable unit. Based on the inventories of radionuclides discharged to the trenches and their potential for continuing release to the environment, the 200-BP-2 and 200-BP-3 Operable Units should be investigated next.

The 200-BP-5 Operable Unit will be investigated after the 200-BP-3 Operable Unit. The completion of the ERA for the 216-B-5 Reverse Well reduces the priority for investigation of the remaining waste management units within the operable unit.

Based on inventory, the order for investigation for the remaining operable units should be 200-BP-9, 200-IU-6, 200-BP-8, 200-BP-10, 200-BP-6, and 200-SS-1. The 200-BP-7 Operable Unit includes the Single-Shell Tank Farms and is recommended for dispositioning under the Single-Shell Tank Closure Program.

The summarized priority for investigation is:

- 200-BP-11
- 200-BP-4
- 200-BP-2
- 200-BP-3
- 200-BP-5
- 200-BP-9
- 200-IU-6
- 200-BP-8
- 200-BP-10
- 200-BP-6
- 200-SS-1.

9.3.4 RCRA Facility Interface

A number of RCRA waste management units exist in the B Plant Aggregate Area. They include:

- Liquid Effluent Retention Facility (LERF)

- 218-E-10 Burial Ground
- 200 East Powerhouse Ashpit
- 244-BX Receiver Tank
- B Plant Waste Concentrator
- B Plant Waste Piles
- B Plant Radioactive Organic Waste Solvent Tanks Nos. 1 through 7
- 2101-M Pond
- 200-E-8 Borrow Pit Demolition Site
- Tank systems in the 241-B, 241-BX, and 241-BY Tank Farms
- 216-B-63 Trench
- 216-B-3-3 Ditch
- 216-B-3 Pond
- 216-B-3A Pond
- 216-B-3B Pond
- 216-B-3C Pond

In addition, the 216-A-29 Ditch, which has been recommended for transfer from the 200-PO-5 Operable Unit to the 200-BP-11 Operable Unit, is also identified as a RCRA Part A interim status waste management unit. The ditch has been deactivated and stabilized, and a closure plan is being developed.

9.3.4.1 Active RCRA TSD Facilities. The LERF is currently under construction and is being built to meet the requirements for a RCRA TSD facility. A Part B final status permit will be issued for LERF. The 218-E-10 Burial Ground, the 200 East Powerhouse Ashpit, the 244-BX Receiver Tank, and operational equipment and storage sites within the B Plant Aggregate Area described in Section 2.6 are currently operating under RCRA Part A interim status. A Part B final status disposal permit is being sought for the 218-E-10 Burial Ground.

A Part B permit application has been submitted to Ecology for review; approval is expected by 1995. Likewise, a treatment and storage Part B final status permit is being sought for several units at the 221-B Building. These units are the B Plant Waste Concentrator, the B Plant Waste Piles, and the B Plant Radioactive Organic Waste Solvent Tanks No. 1 through 7.

All of the units described in the preceding paragraph will continue to be active, operating facilities. Closure is not anticipated to occur for some time. Thus, there will be no need to interface with the past practices program for these units at this time. In the event that any of these RCRA TSD facilities are closed while past practices investigation or remediation activities are still occurring, it will be necessary at that time for the RCRA TSD closure activities to interface with the past practices program. Currently, it is recommended that closure of LERF, 218-E-10 Burial Ground, 200 East Powerhouse Ashpit, 244-BX Receiver Tank, B Plant Waste Concentrator, B Plant Waste Piles, and B Plant Radioactive Organic Waste Solvent Tanks be conducted completely under the RCRA TSD Program.

9.3.4.2 RCRA Clean Closures. The 2101-M Pond will undergo RCRA clean closure. The RCRA closure sampling and analysis plan for pond soil sampling and analysis, groundwater monitoring, and sediment sampling was completed in 1991. Administrative and physical controls to assure that no dangerous wastes are discharged have been implemented. All discharges of water to the 2101-M Pond are scheduled to cease by June 1995. To date, sampling and analyses have not detected any significant chemical or radionuclide contamination. It is recommended that closure and, if necessary, future remediation of the pond remain completely under the RCRA Program.

A RCRA clean closure plan is being prepared for the 200-E-8 Borrow Pit. The closure plan for the pit is to be submitted to Ecology and EPA in November 1992. Approval is expected by 1996. It is not expected that past practices at the pit affect other past practice units or activities in the B Plant Aggregate Area. Therefore, it is recommended that closure and, if necessary, remediation of the 200-E-8 Borrow Pit be performed completely under the RCRA Program.

Clean closure is also anticipated for a number of units included in the B Pond System; these are discussed in Section 9.3.4.4.

9.3.4.3 RCRA Single-Shell Tanks. The RCRA regulated 241-B, 241-BX, and 241-BY Tank Farms and associated facilities will be addressed under the Hanford Single-Shell Tank Program and are under a separate Tri-Party Agreement 30-year schedule. Therefore, although there will be RCRA interfaces on these tanks, these interfaces are not addressed under this AAMS.

9.3.4.4 B Pond System. As discussed in Section 9.3.2, it is recommended that the waste management units in the 200-BP-8 Operable Unit be consolidated into the 200-BP-11 Operable Unit. It will also be recommended that the 216-A-29 Ditch be transferred from the 200-PO-5 Operable Unit to the 200-BP-11 Operable Unit. This would result in the 200-BP-11 Operable Unit including the ponds, ditches and trench associated with the B Pond System.

The waste management units in the B Pond System have been recommended for consideration under the IRM path. To be successful, the LFIs/IRMs should be integrated with ongoing RCRA closure activities to ensure maximum efficiency, compatibility of remedial measures, and minimal duplication of efforts. Recommendations for such integration are discussed in detail, below.

All of the RCRA TSDs in the B Pond System are scheduled to undergo closure, with some of the units expected to be subject to post-closure care. Closure plans have been prepared for a number of the units. To date, these closure plans have not completely incorporated the necessary components of the RFI/CMS process. As presently written, the closure plans also pose the potential that radionuclide contamination would have to be addressed through followup investigations and, if necessary, remediation. Thus, it is recommended that TSD facility closure activities and the RFI/CMS investigation and remediation activities for past practice units in the B Pond System be integrated. To accomplish the integration, it is recommended that the existing B Pond closure plan be amended to include the past practice program. The resulting document would be a combined B Pond closure plan and RFI/CMS work plan that would include closure plans for the 216-A-29 Ditch and 216-B-63 Trench.

It is recommended that risk assessment and determination of clean closure be performed in a consistent manner for all units in the B Pond System. To accomplish this, all units would be evaluated in accordance with the risk assessment methodology being developed and agreed to between DOE, EPA, and Ecology under Tri-Party Agreement Milestone M-29-03. The latest presentation of the risk assessment protocols appears in *The Hanford Site Baseline Risk Assessment Methodology* (DOE/RL 1992b). It is expected that these risk assessment protocols will be at least as conservative as the guidelines established under the proposed 40 CFR Part 264 Subpart S EPA regulations published in the July 27, 1990 Federal Register. The Subpart S guidelines will provide the bases for closing RCRA units in a manner that will prevent future threats to human health and the environment. Use of the Milestone M-29-03 methodology would both satisfy the past practices risk assessment procedures and allow evaluation of whether or not clean closure of RCRA TSD units had been accomplished.

9.3.4.4.1 216-B-63 Trench. The 216-B-63 Trench has received mixed wastes. It is an active unit, although it is not receiving any wastes at this time, and is currently slated for

RCRA closure. It has been proposed that the 216-B-63 Trench undergo RCRA closure, integrated with the closure activities proposed for the 216-B-3 Pond system. The RCRA closure plan would include sampling of the trench to determine the nature and extent of the suspected contamination.

It is recommended that the LFIs/IRMs recommended for the 216-B-2-1, 216-B-2-2, 216-B-2-3 Ditches and the 216-B-63 Trench be integrated. This will require interfacing with the RCRA Program. The LFI/IRM work plans should be integrated with anticipated closure activities at the 216-B-63 Trench.

9.3.4.4.2 216-B-3-3 Ditch and 216-A-29 Trench. The 216-B-3-3 Ditch and 216-A-29 Trench are currently operating under RCRA Part A interim status. The 216-B-3-3 Ditch is included under a RCRA closure/post-closure plan submitted for the 216-B-3 Pond system to Ecology and EPA in March 1990. Sampling of vadose zone soil near the ditch will occur and the ditch will be interim stabilized. Interim stabilization will involve backfilling the 216-B-3-3 Ditch. A closure plan is to be developed for the 216-A-29 Trench, which is discussed in detail in the PUREX AAMS report.

It is recommended that the LFIs/IRMs recommended for the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches and the 216-A-29 Trench be integrated. The required interfacing with the RCRA Program should ensure that the LFI/IRM work plans appropriately account for anticipated closure activities.

9.3.4.4.3 216-B-3 Pond System. The 216-B-3 Pond system is a group of currently active waste management units that have received a variety of mixed wastes since 1945. The 216-B-3 Pond system includes the 216-B-3, 216-B-3A, 216-B-3B, and 216-B-3C Ponds (as well as the 216-B-3-3 Ditch, already discussed above). All of these units are currently operating under RCRA Part A interim status. A RCRA closure/post-closure plan was submitted to Ecology and EPA in March 1990. Approval of a final version of the plan is expected by 1994. The closure plan for the 216-B-3 Pond system includes several steps, as discussed below.

The 216-B-3A, 216-B-3B, and 216-B-3C Ponds are planned for clean closure under RCRA. Clean closure will be contingent upon the results of ongoing soil sampling activities at the ponds. Based on their operational history and sampling to date, none of the ponds are expected to contain significant contamination. If contamination above clean closure limits is found, the contaminated soil will be removed to the 216-B-3 Pond. The RCRA closure plan will address closure activities and additional verification sampling to be conducted at the 216-B-3A, 216-B-3B, and 216-B-3C Ponds.

At this time, it is not expected that the 216-B-3 Pond can be clean closed under RCRA. Thus, it will likely be closed as a landfill and subject to post-closure care and monitoring. Current plans call for sampling vadose zone soils at the pond, followed by interim stabilization. The interim stabilization will be accomplished by placing a cover of clean soil on top of the 216-B-3 Pond, following the contour of the current pond with the minimum required thickness rather than backfilling to grade. After sampling and interim stabilization activities are completed, a risk assessment will be conducted (based on the proposed 40 CFR Part 264 Subpart S standards) to determine the design and size of a RCRA closure cover to be placed over the pond. A detailed cover design will not be included in the closure plan, but will be developed as a part of the RFI/CMS process. Following installation of the closure cover, post-closure care will be performed by maintenance of the closure cover, monitoring the groundwater, preventing run-on and run-off, and protecting against potential causes of cover damage.

It is recommended that the LFIs/IRMs recommended for the 216-B-3, 216-B-3A, 216-B-3B and 216-B-3C Ponds be integrated with the ongoing closure activities. In particular, it is recommended that interim stabilization measures anticipated for the 216-B-3 Pond be reviewed relative to radionuclide contaminants to ensure consistency with IRM path considerations. The required interfacing with the RCRA Program should ensure that the LFI/IRM work plans appropriately account for anticipated closure activities.

9.4 FEASIBILITY STUDY

Two types of the FS will be conducted to support remediation in the 200 Areas including focused and the final FS. Focused feasibility studies (FFSs) are studies in which a limited number of waste management units or remedial alternatives are considered. Final FS will be prepared to provide the data necessary to support the preparation of final ROD. Insufficient data exists to prepare either a focused or final FS for any waste management units or group of units within the B Plant Aggregate Area. Sufficient data are considered available to prepare a FFS on selected remedial alternatives.

9.4.1 Focused Feasibility Study

Both LFIs and IRMs are planned for the B Plant Aggregate Area for individual waste management units or waste management unit groups. The IRMs will be implemented as they are approved, and the FFS will be prepared to support their implementation. The FFS applied in this manner is intended to examine a limited number of alternatives for a specific site or groups of sites. The FFS supporting IRMs will be based on the technology screening process applied in Section 7.0, engineering judgement, and/or new characterization data such as that generated by an LFI.

Recommendations for the FFS in support of IRMs are not provided in this report because the of limited data availability. In most cases, LFIs will be conducted at sites initially identified for IRMs. The information gathered is considered necessary prior to making a final determination whether an IRM is actually necessary or whether a remedy can be selected.

Rather than being driven by an IRM, the FFS will also be prepared to evaluate select remedial alternatives. In this case the FFS focuses on technologies or alternatives that are considered to be viable based on their implementability, cost, and effectiveness and have broad application to a variety of sites. The following recommendations are made for FFS that focus on a particular technology or alternative:

- Capping
- Ex situ treatment of contaminated soils
- In situ stabilization.

These recommendations reflect select technologies developed in Section 7.0 of this report.

The FFS is intended to provide a detailed analysis of select remedial alternatives. The results of the detailed analysis provide the basis for identifying preferred alternatives. The detailed analysis for alternatives consists of the following components:

- Further definition of each alternative, if appropriate, with respect to the volumes or areas of contaminated environmental media to be addressed, the technologies to be used, and any performance requirements associated with those technologies. Remedial investigations and treatability studies, if conducted, will also be used to further define applicable alternatives.
- An assessment and summary of each alternative against evaluation criteria specified in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988b).
- A comparative analysis of the alternatives that will facilitate the selection of a remedial action.

9.4.2 Final Feasibility Study

To complete the remediation process for an aggregate area, a final or summary FS will be prepared. This study will address those sites not previously evaluated and will summarize the results of preceding evaluations. The overall study and evaluation process for an aggregate area will consist of a number of FFSs, field investigations, and interim RODs. All of this study information will be summarized in one final FS to provide the data necessary for the final ROD. The summary FS will likely be conducted on an aggregate area basis; however, future considerations may indicate that a larger scope is appropriate.

9.5 TREATABILITY STUDIES

A range of technologies which are likely to be considered for remediation of sites within the B Plant Aggregate Area were discussed in Section 7.3. The range of technologies included:

- Engineered multimedia cover
- In situ grouting
- Excavation and soil treatment
- In situ vitrification
- Excavation, treatment, and disposal of transuranic (TRU) radionuclides
- In situ soil vapor extraction of volatile organic compounds (VOCs).

Treatability testing will be required to conduct a detailed analysis for most of the technologies. Relevant EPA guidance will be relied upon to conduct these future treatability studies. A summary of treatability testing needs outlined in Section 7.3 is as follows:

- Engineered multimedia cover--performance testing (pilot-scale testing) of conceptual designs is needed.
- In situ grouting--testing required to optimize injection properties of grout and verify effectiveness in stabilizing contaminants.

- Excavation and soil treatment--testing of dust control measures, soil treatment reagents, and contacting methods will be required. Some limited soil washing bench scale studies have been initiated.

- In situ vitrification--testing required to verify contaminant stabilization effectiveness and to establish operating parameters. Some vitrification pilot testing is ongoing.

- Excavation, treatment, and disposal of TRU radionuclides--testing to evaluate dust control measures and stabilization or vitrification effectiveness and to establish operating parameters is required.

- In situ soil vapor extraction of VOCs--extraction effectiveness needs to be verified and operating parameters require development. A program is currently under way for field testing of vapor extraction techniques.

As treatability testing of the various alternatives progresses, other parameters are likely to be identified which require further development.

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
Tanks and Vaults							
241-B-361 Settling Tank	--	--	--	--	X	--	HSFP
Cribs and Drains							
216-B-7A Crib	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-7B Crib	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-8TF Crib/Tile Field	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-9TF Crib/Tile Field	--	X	X	--	--	X	RARA-Collapse Potential
216-B-10A Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-10B Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-12 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-14 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-15 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-16 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-17 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-18 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-19 Crib	--	X	X	--	--	X	RARA-Collapse Potential
216-B-43 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-44 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-45 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-46 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-47 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-48 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-49 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-50 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-55 Crib	--	X	X	--	--	--	Active-DWMP/Surface Contamination
216-B-56 Crib	--	--	--	--	--	--	--
216-B-57 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-60 Crib	--	--	--	--	X	--	--
216-B-61 Crib	--	--	--	--	X	--	Work in progress under 200-BP-1 RI/FS Work Plan
216-B-62 Crib	--	--	--	--	X	--	Active-DWMP
CTF North of 2703-E	--	--	--	--	X	--	--
216-B-13 French Drain	--	--	--	--	X	--	--
216-B-51 French Drain	--	X	X	--	--	X	RARA-Surface Contamination
Reverse Wells							
216-B-4 Reverse Well	--	X	X	--	--	--	--
216-B-5 Reverse Well	X	--	--	--	--	--	Surface Contamination
216-B-6 Reverse Well	--	X	X	--	--	--	--
216-B-11A Reverse Well	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
216-B-11B Reverse Well	--	X	X	--	--	X	RARA-Collapse Potential/Surface Contamination
Ponds, Ditches, and Trenches							
216-B-3 Pond	--	X	X	--	--	X	Active-DWMP/RARA-Surface Contamination
216-B-3A Pond	--	X	X	--	--	--	Active-DWMP

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-3B Pond	--	X	X	--	--	--	Active-DWMP
216-B-3C Pond	--	X	X	--	--	--	Active-DWMP
216-A-25 Pond	--	--	--	--	X	--	--
216-E-28 Contingency Pond	--	--	--	--	X	--	--
216-N-8 Pond	--	--	--	--	X	--	--
216-B-2-1 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-2-2 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-2-3 Ditch	--	X	X	--	--	X	RARA-Surface Contamination
216-B-3-1 Ditch	--	X	X	--	--	--	--
216-B-3-2 Ditch	--	X	X	--	--	--	--
216-B-3-3 Ditch	--	X	X	--	--	--	Active-DWMP
216-B-20 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-21 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-22 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-23 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-24 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-25 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-26 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-27 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-28 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-29 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-30 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-31 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-32 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-33 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-34 Trench	--	--	--	--	X	X	RARA-Collapse Potential/Surface Contamination
216-B-35 Trench	--	--	--	--	X	--	--
216-B-36 Trench	--	--	--	--	X	--	--
216-B-37 Trench	--	--	--	--	X	--	--
216-B-38 Trench	--	--	--	--	X	--	--
216-B-39 Trench	--	--	--	--	X	--	--
216-B-40 Trench	--	--	--	--	X	--	--
216-B-41 Trench	--	--	--	--	X	--	--
216-B-42 Trench	--	--	--	--	X	--	--
216-B-52 Trench	--	--	--	--	X	--	--
216-B-53A Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-53B Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-54 Trench	--	--	--	--	X	X	RARA-Surface Contamination
216-B-58 Trench	--	--	--	--	X	X	RARA-Collapse Potential
216-B-63 Trench	--	X	X	--	--	--	Active-DWMP Grouped with 216-B-2-1 Ditch
Septic Tanks and Associated Drain Fields							
2607-E1 Septic Tank	--	--	--	--	X	--	Active

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
2607-E2 Septic Tank	--	--	--	--	X	--	Active
2607-E3 Septic Tank/Drain Field	--	--	--	--	X	--	Active
2607-E4 Septic Tank	--	--	--	--	X	--	Active
2607-E7B Septic Tank	--	--	--	--	X	--	Active
2607-E8 Septic Tank	--	--	--	--	X	--	Active
2607-E9 Septic Tank	--	--	--	--	X	--	Active
2607-E11 Septic Tank	--	--	--	--	X	--	Active
2607-EB Septic Tank	--	--	--	--	X	--	Active
2607-EH Septic Tank	--	--	--	--	X	--	Active
2607-EK Septic Tank	--	--	--	--	X	--	Active
2607-EM Septic Tank	--	--	--	--	X	--	Active
2607-EN Septic Tank	--	--	--	--	X	--	Active
2607-EO Septic Tank	--	--	--	--	X	--	Active
2607-EP Septic Tank	--	--	--	--	X	--	Active
2607-EQ Septic Tank	--	--	--	--	X	--	Active
2607-ER Septic Tank	--	--	--	--	X	--	Active
2607-GF Septic Tank	--	--	--	--	X	--	Active
Basins							
207-B Retention Basin	--	X	X	--	--	--	Active-DWMP
216-B-59B Retention Basin	--	--	--	--	X	--	Active-DWMP

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
216-B-64 Retention Basin	--	X	X	--	--	X	RARA-Surface Contamination
				Burial Sites			
218-E-2 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-2A Burial Ground	--	--	--	--	X	--	--
218-E-3 Burial Ground	--	--	--	--	X	--	Exhumed/Released
218-E-4 Burial Ground	--	X	X	--	--	--	--
218-E-5 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-5A Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
218-E-6 Burial Ground	--	--	--	--	X	--	Exhumed/Released
218-E-7 Burial Ground	--	--	--	--	X	X	RARA-Collapse Potential
218-E-9 Burial Ground	--	X	X	--	--	X	RARA-Surface Contamination
200 Area Construction Pit	--	--	--	--	X	--	--
				Unplanned Releases			
UN-200-E-7	--	--	--	--	X	--	--
UN-200-E-9	--	--	--	--	X	--	--
UN-200-E-14	--	--	--	--	X	--	--
UN-200-E-41	--	X	X	--	--	--	Grouped with UN-200-E-69
UN-200-E-43	--	X	X	--	--	--	Grouped with 216-B-57
UN-200-E-44	--	X	X	--	--	--	--
UN-200-E-52	--	X	X	--	--	--	Grouped with UN-200-E-69
UN-200-E-54	--	--	--	--	X	--	--

Table 9-1. Summary of the Results of Remediation Process Path Assessment.

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
UN-200-E-55	--	--	--	--	X	--	--
UN-200-E-61	--	--	--	--	X	--	--
UN-200-E-63	--	X	X	--	--	X	RARA-Surface Contamination
UN-200-E-64	--	X	X	--	--	--	RARA-Surface Contamination
UN-200-E-69	--	X	X	--	--	--	--
UN-200-E-79	--	--	--	--	X	--	--
UN-200-E-80	--	X	X	--	--	--	--
UN-200-E-83	--	X	X	--	--	X	RARA-Surface Contamination
UN-200-E-87	--	--	--	--	X	--	--
UN-200-E-90	--	X	X	--	--	--	--
UN-200-E-92	--	--	--	--	X	--	--
UN-200-E-95	--	X	X	--	--	--	Surface Contamination
UN-200-E-101	--	--	--	--	X	--	--
UN-200-E-103	--	X	X	--	--	--	Grouped with UN-200-E-44
UN-200-E-112	--	--	--	--	X	--	--
UN-200-E-140	--	--	--	--	X	--	--
UPR-200-E-4	--	--	--	--	X	--	--
UPR-200-E-32	--	X	X	--	--	X	RARA-Surface Contamination
UPR-200-E-34	--	--	--	--	X	--	--
UPR-200-E-51	--	--	--	--	X	--	--

Table 9-1. Summary of the Results of Remediation Process Path Assessment. Page 8 of 8

Waste Management Unit	ERA	IRM	LFI	RA	RI	OPS	Remarks
UPR-200-E-84	--	X	X	--	--	X	RARA-Surface Contamination
UPR-200-E-138	--	X	X	--	--	--	Grouped with 216-B-2-1 Ditch

ERA - Expedited Response Action
IRM - Interim Remedial Measure
LFI - Limited Field Investigation
RA - Risk Assessment
RI - Remedial Investigation
OPS - Operational Programs
DWMP - Defense Waste Management Program
RARA - Radiation Area Remedial Action Program
HSFP - Hanford Surplus Facilities Program

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
Tanks and Vaults													
241-B-361 Settling Tank	Y	N	–	–	–	–	–	–	N	–	–	–	N
Cribs and Drains													
216-B-7A Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-7B Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-8TF Crib/Tile Field	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-9TF Crib/Tile Field	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-10A Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-10B Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-12 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-14 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-15 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-16 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-17 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-18 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-19 Crib	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-43 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-44 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-45 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-46 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-47 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-48 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-49 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-50 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-55 Crib	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-56 Crib	N	–	–	–	–	–	–	–	N	–	–	–	N
216-B-57 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-60 Crib	N	–	–	–	–	–	–	–	N	–	–	–	N
216-B-61 Crib[a]	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-62 Crib	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
CTF North of 2703-E	Y	Y	N	–	–	–	–	–	N	–	–	–	N
216-B-13 French Drain	Y	Y	N	–	–	–	–	–	N	–	–	–	N
216-B-51 French Drain	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
Reverse Wells													
216-B-4 Reverse Well	Y	Y	Y	Y	N	--	--	--	Y	N	--	Y	--
216-B-5 Reverse Well	Y	Y	Y	Y	Y	Y	N	N	--	--	--	--	--
216-B-6 Reverse Well	Y	Y	Y	Y	N	--	--	--	Y	N	--	Y	--
216-B-11A Reverse Well	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
216-B-11B Reverse Well	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
Ponds, Ditches, and Trenches													
216-B-3 Pond	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
216-B-3A Pond	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
216-B-3B Pond	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
216-B-3C Pond	Y	Y	Y	N	--	--	--	--	Y	N	--	Y	--
216-A-25 Pond	N	--	--	--	--	--	--	--	N	--	--	--	N
216-E-28 Contingency Pond	N	--	--	--	--	--	--	--	N	--	--	--	N
216-N-8 Pond	Y	Y	Y	Y	N	--	--	--	N	--	--	--	N
216-B-2-1 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--
216-B-2-2 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	--	Y	--

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-2-3 Ditch	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
216-B-3-1 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3-2 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-3-3 Ditch	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
216-B-20 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-21 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-22 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-23 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-24 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-25 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-26 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-27 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-28 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-29 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-30 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-31 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-32 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
216-B-33 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-34 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-35 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-36 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-37 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-38 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-39 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-40 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-41 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-42 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-52 Trench	Y	Y	N	--	--	--	--	--	N	--	--	--	N
216-B-53A Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-53B Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-54 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-58 Trench	Y	Y	Y	Y	Y	Y	N	Y	N	--	--	--	N
216-B-63 Trench	Y	Y	Y	Y	N	--	--	--	N	--	--	--	N
Septic Tanks and Associated Drain Fields													
2607-E1 Septic Tank	N	--	--	--	--	--	--	--	N	--	--	--	N
2607-E2 Septic Tank	N	--	--	--	--	--	--	--	N	--	--	--	N

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
2607-E3 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E4 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E7B Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E8 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E9 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-E11 Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EB Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EH Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EK Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EM Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EN Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EO Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EP Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-EQ Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-ER Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
2607-GF Septic Tank	N	–	–	–	–	–	–	–	N	–	–	–	N
Basins													
207-B Retention Basin	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
216-B-59B Retention Basin	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
216-B-64 Retention Basin	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
Burial Sites													
218-E-2 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-2A Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-3 Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-4 Burial Ground	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
218-E-5 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-5A Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
218-E-6 Burial Ground	N	–	–	–	–	–	–	–	N	–	–	–	N
218-E-7 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	N	–	–	–	N
218-E-9 Burial Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
200-East Area Construction Pit	N	–	–	–	–	–	–	–	N	–	–	–	N
Unplanned Releases													
UN-200-E-7	Y	Y	N	–	–	–	–	–	N	–	–	–	N

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
UN-200-E-9	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-14	N	–	–	–	–	–	–	–	N	–	–	–	N
UN-200-E-41	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-43	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-44	Y	Y	Y	Y	N	–	–	–	Y	N	–	Y	–
UN-200-E-52	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
UN-200-E-54	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-55	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-61	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-63	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UN-200-E-64	Y	Y	Y	Y	N	–	–	–	Y	N	–	Y	–
UN-200-E-69	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
UN-200-E-79	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-80	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
UN-200-E-83	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UN-200-E-87	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-90	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
UN-200-E-92	Y	Y	N	–	–	–	–	–	N	–	–	–	N

Table 9-2. B Plant Aggregate Area Data Evaluation Decision Matrix.

	ERA Evaluation Path								IRM Evaluation Path			LFI Path	Final Remedy
Waste Management Unit	Is an ERA Justified?	Release?	Pathway?	Quantity?	Concentration?	Treatment Availability?	Adverse Consequences?	Operational Programs?	High Priority?	Data Adequate?	Adverse Consequences?	Collect Data	Data Adequate?
UN-200-E-95	Y	Y	Y	N	–	–	–	–	Y	N	–	Y	–
UN-200-E-101	Y	Y	Y	N	–	–	–	–	N	–	–	–	N
UN-200-E-103	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-112	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UN-200-E-140	Y	Y	N	–	–	–	–	–	N	–	–	–	N
UPR-200-E-4	Y	Y	N.	–	–	–	–	–	N	–	–	–	N
UPR-200-E-32	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UPR-200-E-34	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N
UPR-200-E-51	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N
UPR-200-E-84	Y	Y	Y	Y	Y	Y	N	Y	Y	N	–	Y	–
UPR-200-E-138	Y	Y	Y	Y	N	–	–	–	N	–	–	–	N

[a] Work is in progress under the 200-BP-1 RI/FS Work Plan
* DOE/RL 1991a
Other information from WIDS and HISS database

Table 9-3. Waste Management Units and Unplanned Releases to be Addressed by Other Programs. Page 1 of 5

Waste Management Unit	Site Type	Program	Active/ Inactive	Operable Unit
2703-E	Hazardous Waste Staging Area	DWMP	Active	200-SS-1
2704-E	Hazardous Waste Staging Area	DWMP	Active	200-SS-1
2715-EA	Hazardous Waste Staging Area	DWMP	Active	200-SS-1
226-B	Hazardous Waste Staging Area	DWMP	Active	200-BP-6
Tanks and Vaults				
241-B-101	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-102	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-103	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-104	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-105	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-106	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-107	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-108	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-109	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-110	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-111	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-112	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-201	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-202	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-204	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-101	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-108	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-102	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-103	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-104	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-105	Single-Shell Tank	HSSTP	Inactive	200-BP-7

Table 9-3. Waste Management Units and Unplanned Releases to be Addressed by Other Programs. Page 2 of 5

Waste Management Unit	Site Type	Program	Active/ Inactive	Operable Unit
241-BY-106	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-107	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-108	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-109	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-110	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-111	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BY-112	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-101	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-102	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-103	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-104	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-105	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-106	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-107	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-108	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-109	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-110	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-111	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-BX-112	Single-Shell Tank	HSSTP	Inactive	200-BP-7
241-B-301B	Catch Tank	HSSTP	Inactive	200-BP-7
241-B-302B	Catch Tank	HSSTP	Inactive	200-BP-5
241-BX-302A	Catch Tank	HSSTP	Inactive	200-BP-7
241-BX-302B	Catch Tank	HSSTP	Inactive	200-BP-6
241-BX-302C	Catch Tank	HSSTP	Inactive	200-BP-6
241-ER-311	Catch Tank	HSSTP	Active	200-BP-9
270-E	Condensate Neutralization Tank	HSFP	Inactive	200-BP-6
244-BXR	Receiving Vault	HSSTP	Inactive	200-BP-7

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Table 9-3. Waste Management Units and Unplanned Releases to be Addressed by Other Programs. Page 3 of 5

Waste Management Unit	Site Type	Program	Active/ Inactive	Operable Unit
Ponds, Ditches, and Trenches				
2101-M	Pond	RCRA	Active	200-SS-1
Transfer Facilities, Diversion Boxes, and Pipelines				
241-B-151	Diversion Box	HSSTP	Inactive	200-BP-7
241-B-152	Diversion Box	HSSTP	Inactive	200-BP-7
241-B-153	Diversion Box	HSSTP	Inactive	200-BP-7
241-B-154	Diversion Box	HSSTP	Inactive	200-BP-5
241-B-252	Diversion Box	HSSTP	Inactive	200-BP-7
241-BR-152	Diversion Box	HSSTP	Inactive	200-BP-7
241-BX-153	Diversion Box	HSSTP	Inactive	200-BP-7
241-BX-154	Diversion Box	HSSTP	Inactive	200-BP-6
241-BX-155	Diversion Box	HSSTP	Inactive	200-BP-6
241-BXR-151	Diversion Box	HSSTP	Inactive	200-BP-7
241-BXR-152	Diversion Box	HSSTP	Inactive	200-BP-7
241-BXR-153	Diversion Box	HSSTP	Inactive	200-BP-7
241-BYR-152	Diversion Box	HSSTP	Inactive	200-BP-7
241-BYR-153	Diversion Box	HSSTP	Inactive	200-BP-7
241-BYR-154	Diversion Box	HSSTP	Inactive	200-BP-7
241-ER-151	Diversion Box	HSSTP	Inactive	200-BP-9
241-ER-152	Diversion Box	HSSTP	Active	200-BP-6
241-B-151	Diversion Box	HSSTP	Inactive	200-BP-9
Burial Sites				
200-E	Powerhouse Ash Pit	DWMP	Active	200-SS-1
200-E-8	Burrow Pit	RCRA	Active	200-BP-10
218-E-10	Burial Ground	DWMP	Active	200-BP-10

Table 9-3. Waste Management Units and Unplanned Releases to be Addressed by Other Programs. Page 4 of 5

Waste Management Unit	Site Type	Program	Active/ Inactive	Operable Unit
Unplanned Releases				
UN-200-E-1		HSSTP	Inactive	200-BP-6
UN-200-E-2		HSSTP	Inactive	200-BP-6
UN-200-E-3		HSSTP	Inactive	200-BP-6
UN-200-E-45		HSSTP	Inactive	200-BP-5
UN-200-E-76		HSSTP	Inactive	200-BP-7
UN-200-E-85		HSSTP	Inactive	200-BP-6
UN-200-E-89		HSSTP	Inactive	200-BP-1
UN-200-E-105		HSSTP	Inactive	200-BP-7
UN-200-E-109		HSSTP	Inactive	200-BP-7
UN-200-E-110		HSSTP	Inactive	200-BP-1
UPR-200-E-5		HSSTP	Inactive	200-BP-7
UPR-200-E-6		HSSTP	Inactive	200-BP-7
UPR-200-E-38		HSSTP	Inactive	200-BP-7
UPR-200-E-73		HSSTP	Inactive	200-BP-7
UPR-200-E-74		HSSTP	Inactive	200-BP-7
UPR-200-E-75		HSSTP	Inactive	200-BP-7
UPR-200-E-77		HSSTP	Inactive	200-BP-5
UPR-200-E-78		HSSTP	Inactive	200-BP-6
UPR-200-E-108		HSSTP	Inactive	200-BP-7
UPR-200-E-116		HSSTP	Inactive	200-BP-7
UPR-200-E-127		HSSTP	Inactive	200-BP-7
UPR-200-E-128		HSSTP	Inactive	200-BP-7
UPR-200-E-129		HSSTP	Inactive	200-BP-7
UPR-200-E-130		HSSTP	Inactive	200-BP-7
UPR-200-E-131		HSSTP	Inactive	200-BP-7
UPR-200-E-132		HSSTP	Inactive	200-BP-7

Table 9-3. Waste Management Units and Unplanned Releases to be Addressed by Other Programs. Page 5 of 5

Waste Management Unit	Site Type	Program	Active/ Inactive	Operable Unit
UPR-200-E-133		HSSTP	Inactive	200-BP-7
UPR-200-E-134		HSSTP	Inactive	200-BP-7
UPR-200-E-135		HSSTP	Inactive	200-BP-7

* DOE/RL 1991a
Other information from WIDS and HISS database
DWMP - Defense Waste Management Program
HSSTP - Hanford Single-Shell Tank Program
HSFP - Hanford Surplus Facilities Program

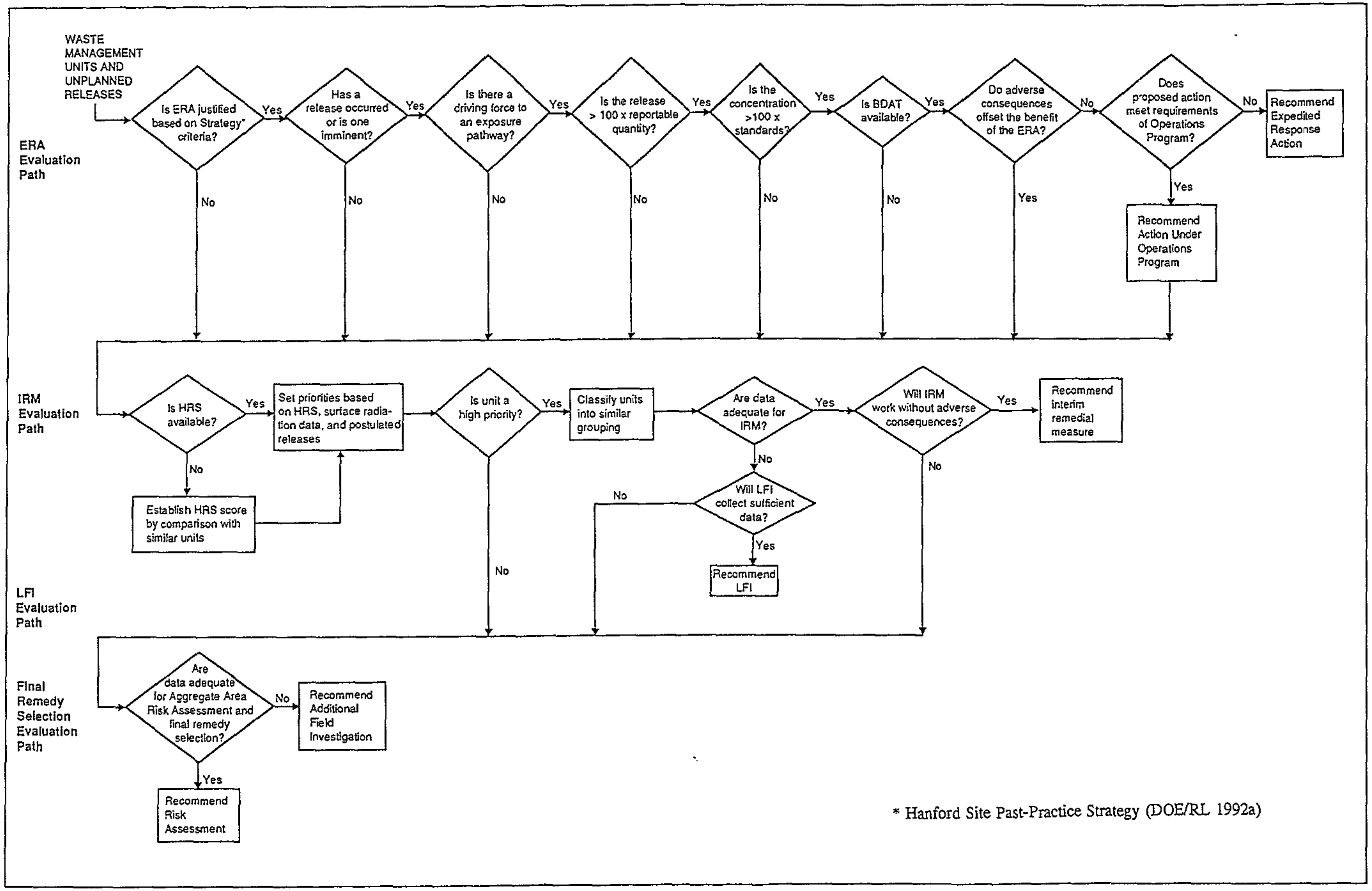

Figure 9-1. 200 Aggregate Area Management Study Data Evaluation Process.

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10.0 REFERENCES

Anderson, J.D., 1990, *History of the 200 Area Tank Farms*, WHC-MR-0132, Westinghouse Hanford Company, Richland, Washington.

Anderson, J.D., D.C. McCann, and B.E. Poremba, 1991, Summary of Radioactive Solid Waste Received in the 200 Areas During Calendar Year 1990, WHC-EP-0125-3, Westinghouse Hanford Company, Richland, Washington.

Baker, S.M., J.L. Devary, R.P. Elmore, R.F. Lorang, A.J. Rossi, and M.D. Freshley, 1988, *U1/U2 Uranium Plume Characterization, Remedial Action Review and Recommendation for Future Action,* WHC-EP-0133, Westinghouse Hanford Company, Richland, Washington.

Ballinger, M.Y., and R.B. Hall, 1991, *A History of Major Hanford Facilities and Precesses Involving Radioactive Material*, PNL-6964 HEDR, Pacific Northwest Laboratory, Richland, Washington.

Bierschenk, W.H., 1959, *Techniques for Estimating the Specific Retention Properties of Hanford Soils,* HW-61644, General Electric, Hanford Atomic Products Operation, Richland, Washington.

Bixler, R.B., 1967, *Hazards Evaluation for Waste Fractionization-B Plant,* ARH-139, Atlantic Richfield Hanford Company, Richland Washington.

Bixler, R.V., G.L. Hansom, and R.R. Jackson, 1981, *Safety analysis Report 204-AR Waste Unloading Facility,* RHO-CD-757, Rockwell Hanford Operations, Richland, Washington.

Bjornstad, B.N., 1984, *Suprabasalt Stratigraphy Within and Adjacent to the Reference Repository Location*, SD-BWI-DP-039, Rockwell Hanford Operations, Richland, Washington.

Bjornstad, B.N., K.R. Fecht, and A.M. Tallman, 1987, *Quaternary Stratigraphy of the Pasco Basin Area, South-central Washington,* RHO-BW-SA-563A, Rockwell Hanford Operations, Richland, Washington.

Bjornstad, B.N., 1990, *Geohydrology of the 218-W-5 Burial Ground, 200-West Area, Hanford Site*, PNL-7336, Pacific Northwest Laboratory, Richland, Washington, May 1990.

Brown, M.J., R.L. P'Pool, and S.P. Thomas, 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Area*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.

Brown, R.E., and H.G. Ruppert, 1950, *The Underground Disposal of Liquid Wastes at the Hanford Works, Washington*, HW-17088, General Electric Company, Richland, Washington.

Brownell, L.E., J.G. Backer, R.E. Isaacson, and D.J. Brown, 1975, *Soil Moisture Transport in Arid Site Vadose Zones*, ARH-ST-123, Atlantic Richfield Hanford Company, Richland, Washington.

Chamness, M.A., S.S. Teel, A.W. Pearson, K.R.O. Barton, R.W. Fruland, and R.E. Lewis, 1992, *PUREX Plant Geologic and Geophysics Data Package for the 200 Aggregate Area Management Study*, Westinghouse Hanford Company, Richland, Washington.

Connelly, M.P., K.A. Lindsey, L. Borghese, and B.H. Ford, 1992, *Hydrogeologic Model for 200 West Groundwater Aggregate Area*, WHC-SD-EN-TI-014, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Coony, R.M., and S.P. Thomas, 1989, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas*, WHC-EP-0141-1, Westinghouse Hanford Company, Richland, Washington.

Delaney, C.D., K.A. Lindsey, and S.P. Reidel, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports*, WHC-SD-ER-TI-0003, Westinghouse Hanford Company, Richland, Washington.

DOE, 1984, *Radioactive Waste Management*, DOE Order 5820.2, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, D.C.

DOE, 1986, *Hanford Inactive Site Survey (HISS) Database*, Phase I - Installation Assessment of Inactive Waste Disposal Sites.

DOE, 1988a, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, D.C.

DOE, 1988b, *Consultation Draft Site Characterization Plan,* DOE/RW-0164, Vols. 1-9, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, Washington, D.C.

DOE/RL, 1987, *216-B-63 Trench Preliminary Closure/Post Closure Plan*, 92-09-SD-92-037, A-T042-008066, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1990a, *RI/FS Work Plan for the 200-BP-1 Operable Unit Hanford Site, Richland, Washington*, DOE/RL-88-32, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1990b, *216-B-3 Pond System Closure/Postclosure Plan*, DOE/RL-89-28, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1991a, *Hanford Site Waste Management Units Report,* DOE-RL,-88-30, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1991b, *Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities in 1990*, DOE-RL-91-03, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1991c, *2101-M Pond Closure Plan,* DOE-RL-88-41, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1992a, *Hanford Site Past-Practice Investigation Strategy*; Draft A, DOE/RL-91-40, U.S. Department of Energy, Richland, Washington.

DOE/RL, 1992b, *Hanford Site Baseline Risk Assessment Methodology*, DOE/RL-91-45, U.S. Department of Energy, Richland Field Office, Richland, Washington.

Ecology, 1991, *The Model Toxics Control Act Cleanup Regulation*, Chapter 173-340 WAC, Washington State Department of Ecology.

Ecology, EPA, and DOE/RL, 1991, *Hanford Federal Facility Agreement and Consent Order Change Packages,* Washington State Department of Ecology, Olympia, Washington, U.S. Environmental Protection Agency, Region X, Seattle, Washington, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1990, *Hanford Federal Facility Agreement and Consent Order* (First Amendment), 89-10 Rev. 1, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Community Relations Plan for the Hanford Federal Facility Agreement and Consent Order,* Olympia, Washington.

Elder, R.E., A.W. Conklin, D.D. Brekke, G.W. Egert, and W.L. Osborne, 1986, *Rockwell Hanford Operations Environmental Surveillance Annual Report - Calendar Year 1985*, RHO-HS-SR-85-13P, Rockwell Hanford Operations, Richland, Washington.

Elder, R.E., G.W. Egert, A.R. Johnson, and W.L. Osborne, 1987, *Rockwell Hanford Operations Environmental Surveillance Annual Report - Calendar Year 1986*, RHO-HS-SR-86-13P, Rockwell Hanford Operations, Richland, Washington.

Elder, R.E., G.W. Egert, A.R. Johnson, and W.L. Osborne, 1988, *Westinghouse Hanford Company Environmental Surveillance Report - Calendar Year 1987*, WHC-EP-0145, Westinghouse Hanford Company, Richland, Washington.

Elder, R.E., S.M. McKinney, and W.L. Osborne, 1989, *Westinghouse Hanford Company Environmental Surveillance Annual Report - 200/600 Areas*, Calendar Year 1988, WHC-EP-0145-1, Westinghouse Hanford Company, Richland, Washington.

EPA, 1980, *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, In-House Report EPA-600/4-80-032, Environmental Monitoring and Support Lab, Cincinnati, Ohio.

EPA, 1983, *Methods for Chemical Analysis of Water and Wastes*, EPA-600/14-79-020, U.S. Environmental Protection Agency, EMSL, Cincinnati, Ohio.

EPA, 1986, *Test Methods for Evaluating Solid Wastes,* SW-846, Third Edition, U.S. Environmental Protection Agency/Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1987, *Data Quality Objectives for Remedial Response Activities — Development Process*, EPA/540/G-87/003, OSWER Directive 9335.3-01, U.S. Environmental Protection Agency, Washington D.C.

EPA, 1988a, *USEPA Contract Laboratory Program Statement of Work for Organic Analysis*, Sample Management Office, U.S. Environmental Protection Agency, Washington D.C.

EPA, 1988b, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA,* Interim Final, EPA 540/G-89-004, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989a, *Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual,* EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989b, *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis,* Sample Management Office, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991a, *Supplemental Risk Assessment Guidance for Superfund*, EPA Region 10.

EPA, 1991b, *Integrated Risk Information System (IRIS)*, Toxnet online database.

Fecht, K.R., G.V. Last, and K.R. Price, 1977, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells: Volumes I, II, and III*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

Fecht, K.R., 1978, Geology of the Gable Mountain - Gable Butte Area, RHO-BWI-LD-5, Rockwell Hanford Operations, Richland, Washington.

Fecht, K.R., S.P. Reidel, and A.M. Tallman, 1987, "Paleodrainage of the Columbia River System on the Columbia Plateau of Washington State--a Summary," in *Selected Papers on the Geology of Washington*, Division of Geology and Earth Resources, Bulletin 77, p. 219-248, edited by J.E. Schuster.

Gee, G.W., and P.R. Heller, 1985, *Unsaturated Water Flow at the Hanford Site: A Review of Literature and Annotated Bibliography*, PNL-5428, Pacific Northwest Laboratory, Richland, Washington.

Gee, G.W., 1987, *Recharge at the Hanford Site: Status Report*, PNL-6403, Pacific Northwest Laboratory, Richland, Washington.

Goodwin, S.M., 1990, *Borehole Completion Data Package for the 216-U-12 Crib*, WHC-MR-0208, Westinghouse Hanford Company, Richland, Washington.

Graham, M.J., M.D. Hall, S.R. Strait, and W.R. Brown, 1981, *Hydrology of the Separations Area,* RHO-ST-42, Rockwell Hanford Operations, Richland, Washington.

Graham, M.J., G.V. Last, and K.R. Fecht, 1984, *An Assessment of Aquifer Intercommunication in the B Pond-Gable Mountain Pond Area of the Hanford Site,* RHO-RE-ST-12 P, Rockwell Hanford Operations, Richland, Washington.

Hanlon, B.M., 1992, *Tank Farm Surveillance and Waste Status Report for January 1992*, WHC-EP-0182-48, Westinghouse Hanford Company, Richland, Washington.

Hayward, W.M., 1989, *Gable Mountain Pond Interim Stabilization Final Report*, SD-DD-TI-036, Westinghouse Hanford Company, Richland, Washington.

Hillel, D., 1971, *Soil and Water, Physical Principles and Process*, Academic Press, Inc., New York, New York.

Hoover, J.D. and T. LeGore, 1991, *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246, Westinghouse Hanford Company, Richland, Washington.

Huckfeldt, C.R., 1991a, *Quarterly Environmental Radiological Survey Summary First Quarter 1991 - 100, 200, 300, and 600 Areas*, WHC-SP-0665-0, Westinghouse Hanford Company, Richland, Washington.

Huckfeldt, C.R., 1991b, *Quarterly Environmental Radiological Survey Summary Second Quarter 1991 - 100, 200, 300, and 600 Areas*, WHC-SP-0665-1, Westinghouse Hanford Company, Richland, Washington.

Hughes, M.C., R.K. Wahlen, and R.H. Winship, 1990, *Hanford Surplus Facilities Program Plan*, WHC-EP-0231-3, Westinghouse Hanford Company, Richland, Washington.

Jungfleisch, F.M., 1984, *Preliminary Estimation of the Waste Inventories in Hanford Tanks through 1980,* Rockwell Hanford Operations, Richland, Washington.

Kasza, G.L., S.F. Harris, and M.J. Hartman, 1990, *Ground Water Maps of the Hanford Site*, WHC-EP-0394-1, Westinghouse Hanford Company.

Landeen, D.S., A.R. Johnson, and R.M. Mitchell, 1991, *Status of Birds at the Hanford Site in Southeastern Washington*, WHC-EP-0402, Westinghouse Hanford Company, Richland, Washington.

Last, G.V., B.N. Bjornstad, M.P. Bergeron, D.W. Wallace, D.R. Newcomer, J.A. Schramke, M.A. Chamness, C.S. Cline, S.P. Airhart, and J.S. Wilbur, 1989, *Hydrogeology of the 200 Areas Low-Level Burial Grounds - An Interim Report,* PNL-6820, Westinghouse Hanford Company.

Lindsey, K.A., and D.R. Gaylord, 1989, *Sedimentology and Stratigraphy of the Miocene-Pliocene Ringold Formation, Hanford Site, South-Central Washington,* WHC-SA-0740-FP, Westinghouse Hanford Company, Richland, Washington.

Lindsey, K.A., B.N. Bjornstad, and M.P. Connelly, 1991, *Geologic Setting of the 200 West Area: An Update*, WHC-SD-EN-TI-008, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Lindsey, K.A., B.N. Bjornstad, J. Lindberg, and K. Hoffman, 1992, *Geologic Setting of the 200 East Area: An Update,* WHC-SD-EN-TI-02, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Lundgren, L.L., 1970, *200 East and North Areas Radioactive Liquid Waste Disposal Sites*, ARH-1562, Atlantic Richfield Hanford Company, Richland, Washington.

Luttrell, S.P., M.A. Chamness, and S. Dudziak, 1989, *Interim-Status Ground-Water Monitoring Plan For the 216-B-3 Pond*, WHC-SD-EN-AP-013, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Maxfield, H.L., 1979, *Handbook - 200 Area Waste Sites,* RHO-CD-673, Rockwell Hanford Operations, Richland, Washington.

McCain, R.G. and W.L. Johnson, 1990, *A Proposal Data Quality Strategy for Hanford Site Characterization,* WHC-SD-EN-AP-023, Westinghouse Hanford Company, Richland, Washington.

McCullugh, R.W. and J.R. Cartnell, 1968, *Chronological Record of Significant Events in Chemical Separations Operations*, ARH-780, Atlantic Richfield Hanford Company, Richland, Washington.

Meinhardt, C.C. and J.C. Frostenson, 1979, *Current Status of 200 Area Ponds*, RHO-CD-798, Rockwell Hanford Operations, Richland, Washington.

Mitchell, P.J., 1988, *Effluent Monitoring Plan for the 216-B-3 Pond Monitoring Wells*, Pacific Northwest Laboratories, Richland, Washington.

Myers, C.W., S.M. Price, and J.A. Caggiano, M.P. Cochran, W.J. Czimer, N.J. Davidson, R.C. Edwards, K.R. Fecht, G.E. Holmes, M.G. Jones, J.R. Kunk, R.D. Landon, R.K. Ledgerwood, J.T. Lillie, P.E. Long, T.H. Mitchell, E.H. Price, S.P. Reidel, and A.M. Tallman, 1979, *Geological Studies of The Columbia Plateau: A Status Report,* RHO-BWI-ST-4, Rockwell Hanford Operations, Richland, Washington.

Natural Heritage Program, 1990, *Endangered, Threatened, and Sensitive Vascular Plant Species of Washington,* Department of Natural Resources, Olympia, Washington.

Newcomb, R.C., 1958, "Ringold Formation of the Pleistocene Age in the Type Locality, the White Bluffs, Washington," *American Journal of Science*, Vol. 33, No. 1, p. 328-340.

Newcomb, R.C., and S.G. Brown, 1961, *Evaluation of Bank Storage Along the Columbia River Between Richland and China Bar, Washington,* Water-supply Paper 1539-I, U.S. Geological Survey, Washington, D.C.

Olascoaga, M.A., 1991, *Design Criteria for the Liquid Effluent Retention Facility 242-A Evaporator Condensate Interim Retention Basins,* WHC-SD-W105-FDC-001, Westinghouse Hanford Company, Richland, Washington.

Ortiz, P., 1974, *Engineering Evaluation - Waste Disposal Cribs - 200 Areas*, ARH-3046, Atlantic Richfield Hanford Company, Richland, Washington.

Peterson, K.A., 1990a, *B Plant Process Condensate Stream-Specific Report*, WHC-EP-0342 Addendum 17, Westinghouse Hanford Company, Richland, Washington.

Peterson, K.A., 1990b, *B Plant Steam Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

Peterson, K.A., 1990c, *B Plant Cooling Water Stream-Specific Report*, WHC-EP-0342 Addendum 22, Westinghouse Hanford Company, Richland, Washington.

Peterson, K.A., 1990d, *B Plant Chemical Sewer Stream-Specific Report*, WHC-EP-0342 Addendum 6, Westinghouse Hanford Company, Richland, Washington.

PNL, 1989, *Hanford Site Environmental Report for Calendar Year 1988*, PNL-6825, Pacific Northwest Laboratory.

PSPL, 1982, *Skagit/Hanford Nuclear Project, Preliminary Safety Analysis Report*, Vol. 4, App. 20, Amendment 23, Puget Sound Power and Light Company, Bellevue, Washington.

Reidel, S.P., 1984, "The Saddle Mountains: the Evolution of an Anticline in The Yakima Fold Belt," *American Journal of Science,* Vol. 284, p. 942-978.

Reidel, S.P., and K.R. Fecht, 1981, "Wanapum and Saddle Mountains Basalt in the Cold Creek Syncline Area" in *Subsurface Geology of the Cold Creek Syncline*, RHO-BWI-ST-14, Rockwell Hanford Operations, Richland, Washington.

Reidel, S.P., K.R. Fecht, M.C. Hagood, and T.L. Tolan, 1989a, "The Geologic Evolution of the Central Columbia Plateau," in *Volcanism and Tectonism in the Columbia River Flood-Basalt Province*, Special Paper 239, edited by S.P. Reidel and P.R. Hooper, Geological Society of America, Boulder, Colorado, p. 247-264.

Reidel, S.P., T.L. Tolan, P.R. Hooper, M.H. Beeson, K.R. Fecht, R.D. Bentley, J.L. Anderson, 1989b, "The Grande Ronde Basalt, Columbia River Basalt Group: Stratigraphic Descriptions and Correlations in Washington, Oregon, and Idaho," in *Volcanism and Tectonism in the Columbia River Flood-Basalt Province*, Special Paper 239, edited by S.P. Reidel and P.R. Hooper, Geological Society of America, Boulder, Colorado, p. 21-53.

Reiman, R.T. and T.S. Dahlstrom, 1988, *An Aerial Radiological Survey of the Hanford Site and Surrounding Area, Richland, Washington,* EGG-10617-1062, Performed by EGG/EM for the U.S. Department of Energy under Contract DE AC08-88NV-10617.

RHO, 1986, *Historical Timelines of Hanford Operations*, RHO-HS-5T-10, Rockwell Hanford Operations, Richland, Washington.

Rockhold, M.L., M.J. Fayer, and G.W. Gee, 1988, *Characterization of Unsaturated Hydraulic Conductivity at the Hanford Site*, PNL-6488, Pacific Northwest Laboratory, Richland, Washington.

Rockhold, M.L., M.J. Fayer, G.W. Gee, and M.J. Kanyid, 1990, *Natural Groundwater Recharge and Water Balance at the Hanford Site,* PNL-7215, Pacific Northwest Laboratory, Richland, Washington.

Rogers, L.E. and W.H. Rickard, 1977, *Ecology of the 200 Area Plateau Waste Management Environs: A Status Report*, PNL-2253, Pacific Northwest Laboratory, Richland, Washington.

Roos, R.C., and K.A. Woodworth, 1989, *216-B-3 Pond Characterization of the Hazardous Waste Inventory in the Near-Surface Soil and Sediments*, WHC-SD-EN-AP-016, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Routson, R.C., and V.G. Johnson, 1990, "Recharge Estimates for the Hanford Site 200 Areas Plateau," *Northwest Science*, Vol. 64, No. 3.

Schmidt J.W., C.R. Huckfeldt, A.R. Johnson, and S.M. McKinney, 1990, *Westinghouse Hanford Company Environmental Surveillance Report--200-600 Areas, Calendar Year 1989*, WHC-EP-0145-2, Westinghouse Hanford Company, Richland, Washington.

Schmidt J.W., C.R. Huckfeldt, A.R. Johnson, and S.M. McKinney, 1991, *Westinghouse Hanford Company Environmental Surveillance Report--200-600 Areas, Calendar Year 1990*, WHC-EP-0145-3, Westinghouse Hanford Company, Richland, Washington.

Schmidt, J.W., C.R. Webb, A.R. Johnson, and S.M. McKinney, 1992, *Westinghouse Hanford Company Environmental Surveillance Annual Report--200/600 Areas, Calendar Year 1990*, WHC-EP-0145-4, Westinghouse Hanford Company, Richland, Washington.

Serkowski, J.A. and W.A. Jordan, 1989, *Operational Groundwater Monitoring at the Hanford Site--1988*, WHC-EP-0260, Westinghouse Hanford Company, Richland, Washington.

Serkowski, J.A. and W.A. Jordan, 1989, *Operational Groundwater Monitoring at the Hanford Site--1988*, WHC-EP-0260, Westinghouse Hanford Company, Richland, Washington.

Serne, R.J. and M.I. Wood, 1990, *Hanford Waste-Form Release and Sediment Interaction, A Status Report with Rationale and Recommendations for Additional Studies*, PNL-7297, Pacific Northwest Laboratory.

Smith, G.A., B.N. Bjornstad, and K.R. Fecht, 1989, "Neogene Terrestrial Sedimentation on and Adjacent to the Columbia Plateau; Washington, Oregon, and Idaho," in *Volcanism and Tectonism in the Columbia River Flood-Basalt Province*, Special Paper 239, edited by S.P. Reidel and P.R. Hooper, Geological Society of America, Boulder, Colorado, p. 187-198.

Smith, R.M., 1980, *216-B-5 Reverse Well Characterization Study*, RHO-ST-37, Rockwell Hanford Operations, Richland, Washington.

Smoot, J.L., J.E. Szecsody, B. Sagar, G.W. Gee, and C.T. Kincaid, 1989, *Simulations of Infiltration of Meteoric Water and Contaminant Plume Movement in the Vadose Zone at Single-Shell Tank 241-T-106 at the Hanford Site*, WHC-EP-0332, Westinghouse Hanford Company, Richland, Washington.

Stalos, S. and C.M. Walker, 1977, *Waste Storage Tank Status and Leak Detection Criteria, Volumes 1-4,* RHO-CD-213, Rockwell Hanford Operations, Richland, Washington.

Stenner, R.D., K.H. Cramer, K.A. Higley, S.J. Jette, D.A. Lamar, T.J. McLaughlin, D.R. Sherwood, and N.C. Van Houten, 1988, *Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford*, PNL-6456, Pacific Northwest Laboratory, Richland, Washington.

Stone, W.A., J.M. Thorp, O.P. Gifford, and D.J. Hoitink, 1983, *Climatological Summary for the Hanford Area*, PNL-4622, Pacific Northwest Laboratory, Richland, Washington.

Strait, S.R. and B.A. Moore, 1981, *Aquifer Intercommunication in the Gable Mountain Pond Area, Hanford Site, South-Central Washington*, RHO-ST-38, Rockwell Hanford Operations, Richland, Washington.

Strenge, D.L. and S.R. Peterson, 1989, *Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1*, PNL-7145, Pacific Northwest Laboratory.

Swanson, D.A., T.L. Wright, P.R. Hooper, and R.D. Bentley, 1979, *Revisions in Stratigraphic Nomenclature of the Columbia River Basalt Group*, Bulletin 1457-G, U.S. Geological Survey, Washington, D.C.

Swanson, L.C., D.C. Weeks, S.P. Luttrell, R.M. Mitchell, D.S. Landeen, A.R. Johnson, and R.C. Roos, 1988, *Grout Treatment Facility Environmental Baseline and Site Characterization Report,* WHC-EP-0150, Westinghouse Hanford Company, Richland, Washington.

Tabasinske, R.C., 1958, *Isolation of Abandoned or Depleted Waste Disposal Sites*, HW-57830, General Electric, Richland, Washington

Tallman, A.M., J.T. Lillie, and K.R. Fecht, 1981, "Suprabasalt Sediments of the Cold Creek Syncline Area," in *Subsurface Geology of the Cold Creek Syncline*, RHO-BWI-ST-14, edited by C.W. Myers and S.M. Price, Rockwell Hanford Operations, Richland, Washington.

Tolan, T.L. and S.P. Reidel, 1989, "Structure Map of a Portion of the Columbia River Flood-Basalt Province," in *Volcanism and Tectonism in the Columbia River Flood-Basalt Province,* Special Paper 239, edited by S.P. Reidel and P.R. Hooper, Geological Society of America, Boulder, Colorado, plate 1.

Van Genuchten, M.P., F.J. Lij, and S.R. Yates, 1991, "The RETC Code for Quantifying the Hydraulic Functions of Unsaturated Soils," Robt. S. Kerr Environmental Research Laboratory, Office of Research and Development, United States Environmental Protection Agency, Ada, Oklahoma.

Waite, J.L., 1991, *Tank Wastes Discharged Directly to the Soil at the Hanford Site,* WHC-MR-0227, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988a, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988b, *Properties and Environmental Impact of Ammonia Scrubber Discharge Waste to the 216-A-36B Crib*, WHC-EP-0100, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988c, *Radiation Protection - Safety, Quality Assurance and Security*, WHC-CM-4-10 Westinghouse Hanford Company, Richland, Washington.

WHC, 1988d, *Environmental Investigation and Site Characterization Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan*, WHC-EP-0383, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *284-E Powerplant Wastewater Stream-Specific Report*, WHC-EP-0342, Addendum 24, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *2101-M Laboratory Wastewater Stream-Specific Report*, WHC-EP-0342, Addendum 18, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991a, *Waste Information Data System,* (WIDS), Westinghouse Hanford Company, Richland, Washington.

WHC, 1991b, *Prioritizing Sites for Expedited Response Actions at the Hanford Site,* WHC-MR-0244, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991c, *Phase I Characterization of the 216-B-3 Pond System*, WHC-SD-EN-AP-042, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *200 Area Treated Effluent Disposal Facility (Project W-049H) Wastewater Engineering Report*, WHC-SD-W049H-ER-003, Westinghouse Hanford Company, Richland, Washington.

Womack, J.C. and D.J. Larkin, 1971, *Investigation and Evaluation of 102-BX Tank Leak,* ARH-2035, Atlantic Richfield Hanford Company, Richland, Washington.

Zimmerman, D.A., A.E. Reisenauer, G.D. Black, M.A. Young, 1986, *Hanford Site Water Table Changes 1950 through 1980, Data Observations and Evaluation*, PNL-5506, Pacific Northwest Laboratory, Richland, Washington.